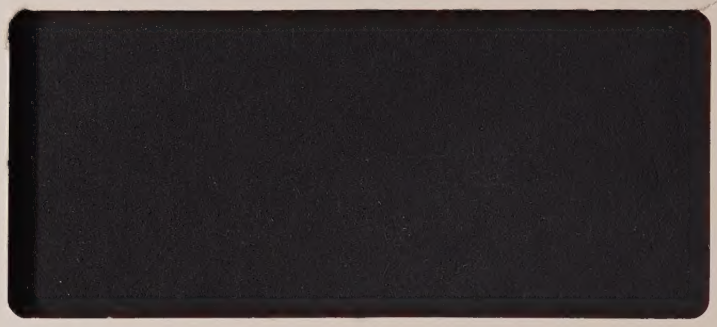
INSTRUMENTS • AMPLIFIERS • NOISE INSTRUMENTATION



INSTRUCTION MANUAL

R. F. TRANSISTOR NOISE ANALYZER

MODEL 340

For Serial No. 123

QUAN-TECH LABORATORIES, INC.

43 So. Jefferson Road Whippany, New Jersey 07981

201-887-5508

CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. We will then advise you of the disposition to be made of the equipment and arrange for repair or replacement. Include model number and serial number when referring to this instrument for any reason.

WARRANTY

Quan-Tech Laboratories, Inc. warrants each instrument manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replace any defective parts thereof. Electronic tubes and batteries are specifically excluded from any liability. This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and when upon our examination it is disclosed to our satisfaction to be defective. If the fault has been caused by misadjustments, misuse, or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

Calibration checks of this instrument can easily be made in accordance with the instruction manual. Routine readjustments should never be attempted. If, however, the instrument has been damaged and requires recalibration or alignment, explicit calibration procedures as defined in the instruction manual must be followed.

If any fault develops, the following steps should be taken:

1. Notify us, giving full details of the difficulty, and include the model number and serial number. On receipt of this information, we will give you service data or shipping instructions.

2. On receipt of shipping instructions, forward the instrument prepaid, to the factory. If requested, an estimate of the charges will be made before the work begins provided the instrument is not covered by the warranty.

SHIPPING

The instruments should be packed in their original containers, or in a strong exterior container and surrounded by two inches of shock absorbing material.

Quan-Tech LABORATORIES

43 SOUTH JEFFERSON ROAD WHIPPANY, NEW JERSEY 07981

201-887-5508

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A. DESCRIPTION

The MODEL 340 R.F. TRANSISTOR NOISE ANALYZER is designed to measure the noise figure of transistors at radio frequencies. The main chassis provides the bias supplies, IF noise channel, controls and metering for the operating parameters and the NOISE FIGURE meter readout. A plug-in unit approach is used to provide the test socket, a manual compensation control, BASE RESISTANCE switch, and the RF circuitry required to determine the test frequency and accomplish automatic calibration. Noise figure can be measured on field-effect as well as bipolar transistors with the readout given directly in db on a front panel meter. DC analogs are provided for noise figure, DC current and DC voltage.

B. SPECIFICATIONS

Noise Figure:	Measured directly in db for base resistance values determined by plug-in unit type.
Meter Ranges:	0 to 20 and 20 to 40 db.
Collector Voltage:	± 1 to 60 volts
Meter Ranges:	3, 10, 30, and 100 volts full scale
Collector Current:	.01 to 30 milliamperes
Meter Ranges:	.03, 0.1, 0.3, 1, 3, 10, and 30 milliamperes full scale
FET Bias:	0 to ± 15 volts
Meter Ranges:	3, 10, and 30 volts full scale
Power Input:	117/234 volts, 50 - 60 Hz
Dimensions:	10½"H x 19"W Standard Rack Panel, 14½" deep overall
Weight:	35 lbs.

A. FIRST TIME OPERATION

The procedure given below will enable an operator to energize the instrument and through the use of an appropriate plug-in unit make basic transistor noise figure measurements. It is highly recommended, however, that the remainder of Section 2 be read to obtain a greater understanding of the function of the equipment.

1. Make certain that the TYPE 1340 PLUG-IN UNIT is fully inserted in its position in the front panel and the retaining screws are tightened.

2. Plug the line cord of the MODEL 340 into a suitable line power receptacle and turn the power switch to ON.

3. Set the front panel controls as follows:

   a. NPN/PNP switch selector for proper type.

   b. COLLECTOR/DRAIN VOLTAGE switch and concentric control for desired transistor collector voltage.

   c. COLLECTOR/DRAIN CURRENT switch to desired current range and concentric control in mid position.

   d. BIAS switch to COLLECTOR/DRAIN CURRENT position.

4. Insert the transistor to be tested in the test socket provided on the TYPE 1340 PLUG-IN UNIT and close the shield cover.

   WARNING: Never insert a transistor in the test socket when the interlock button is depressed, as damage to the transistor may result.

   The instrument should now be operating and the CURRENT Meter should come up to read approximately mid scale.

5. Set the COLLECTOR/DRAIN CURRENT concentric control for the desired collector current.

6. Turn the BASE RESISTANCE switch on the TYPE 1340 PLUG-IN UNIT to the maximum clockwise position. It should be noted that this position is unmarked on the higher frequency units.

7. Tune the CAPACITY control for minimum AGC VOLTAGE and maximum NOISE FIGURE reading, which should occur at the same position of the control.

8. Turn the BASE RESISTANCE switch to the desired position. The NOISE FIGURE meter should now be indicating noise figure for the transistor in the test socket at the frequency indicated on the PLUG-IN UNIT, and for the operating conditions set up on the MODEL 340.

B. FRONT PANEL METER AND CONTROLS

1. COLLECTOR/DRAIN VOLTAGE Meter, Meter Multiplier and Concentric Variable Control.

The COLLECTOR/DRAIN VOLTAGE switch is a multiplier switch for the voltmeter and does not change the collector to emitter voltage. The voltage read on the voltmeter is the magnitude of the collector to emitter voltage of the transistor under test. This voltage may be pre-set before the transistor is inserted in the test socket, as the voltmeter reads the applied voltage correctly with or without a transistor in the jig.

2. COLLECTOR/DRAIN CURRENT Meter, Range Switch and Concentric Variable Control.

a. In both the GATE BIAS VOLTAGE and ground positions of the BIAS switch, the CURRENT meter and range switch function strictly as a multi-range ammeter. Under these conditions the concentric variable control does not function.

b. In the COLLECTOR/DRAIN CURRENT position of the BIAS switch, the range switch and the concentric variable control actually determine the current in the device under test. Automatic bias circuitry provides any bias voltage between plus and minus 10V to achieve the selected collector or drain current. The range of the concentric variable control is from slightly less than one third of full scale to slightly greater than full scale on all current ranges.

3. GATE BIAS VOLTAGE Meter, Range Switch and Concentric Variable Control.

The front panel GATE BIAS VOLTAGE Meter reads the Gate/Base Bias Voltage in all positions of the BIAS switch. In the GATE BIAS VOLTAGE position of the BIAS switch, the concentric control provides capability of applying from plus 15V through 0 to minus 15V to the GATE/BASE of the test socket. Note that the Bias Voltage meter reads correctly only when the test fixture shield cover is closed.

4. NPN, N CHANNEL - PNP, P CHANNEL

The polarity of the COLLECTOR/DRAIN VOLTAGE is selected with this switch. Either positive or negative base/gate voltage is available for both positions of the switch.

5. BIAS switch

The transistor under test may be biased by programing the collector/drain current, the base/gate voltage, or simply by short circuiting the gate and source. Meters and controls are provided for each of these modes of bias.

6. NOISE FIGURE Meter and METER MULTIPLIER

Noise figure is read directly on the panel meter over the range of from 0 to 20 db. An additional meter multiplier is provided to allow 20 - 40 db readings.

7. AGC VOLTAGE Meter

The TYPE 1340 PLUG-IN UNIT and MODEL 340 R.F. TRANSISTOR NOISE ANALYZER combine to form an automatically calibrated noise figure system. The AGC VOLTAGE Meter is simply an indicator of the automatic gain control circuitry.

8. PLUG-IN UNIT

See separate Type 1340 Instruction Manual

A. GENERAL

The MODEL 340 is basically a low frequency IF channel for the noise measuring system. The DC bias voltages and indications of operating conditions are also included in this unit.

The calibration approach in this instrument is that of known gain, known bandwidth. A calibrate signal 20 KHz from the center measuring frequency is used to adjust the variable gain amplifier in the PLUG-IN UNIT. The input to the MODEL 340 is the output of the mixer circuitry of the PLUG-IN UNIT and covers the frequency range of from 0 - 50 KHz. A 20 KHz bandpass filter, AGC detector, and AGC driver provide the AGC voltage, which is fed back to the PLUG-IN UNIT. The actual noise measurement is made in the bandpass shaped by a 7 KHz low pass filter. The noise information is passed through a full wave detector, integrator, log converter and presented directly in noise figure on the front panel meter.

CIRCUIT DESCRIPTION

A. GENERAL

The Block Diagram C-5400 shows the basic connections between the individual circuits in the Model 340. In general the assemblies shown as blocks on C-5400 are separate plug-in printed circuit boards. Reference to the block diagram and appropriate schematic diagrams should enable the reader to follow the individual circuit descriptions.

B. POWER INPUT AND COLLECTOR VOLTAGE SUPPLY (Schematic T-5401)

The line connections, power switch and fuses are shown on this schematic. The multiple secondaries are labelled in accordance with their circuit association. The collector voltage supply is a straightforward regulated power supply. The control of the voltage is obtained by adjusting R117 which has a constant current supplied to it through R107 from the reference diode CR104. A difference or change in the output voltage is monitored by Q102 and amplified through Q103 and the emitter followers Q105 and Q106. If excessive currents are encountered, Q104 will detect the voltage drop across R114 and cut off the supply. The collector supply for Q106 is a simple rectifier and RC filter.

C. POSITIVE 15 VOLT SUPPLY (Floating Ground) (Schematic T-5402)

The plus 15 Volt Supply to operate the current amplifier and control oscillator, floats above ground referenced to the collector voltage supply. In this supply the voltage difference between the base of Q201 and the base of Q204 is amplified by the double differential amplifier consisting of Q201, Q202, Q203 and Q204. This amplified error signal is applied to the base of Q205 which controls the output voltage of the supply. Pre-regulation of the collector of Q203 is obtained through R201, R202, C202 and CR203.

D. NEGATIVE 15 VOLT SUPPLY (Floating Ground) (Schematic T-5403)

The negative 15 Volt Supply is identical to the positive 15 Volt Supply, with the exception of the output connections.

E. POSITIVE 15 VOLT SUPPLY (Schematic T-5404)

NEGATIVE 15 VOLT SUPPLY (Schematic T-5405)

These supplies are identical to the Positive 15V supply with floating ground, with the exception that they are referenced chassis ground. They are used to supply the main amplifier channel.

F. VOLTMETER CIRCUIT
(Schematic T-5406)

The input attenuator to the voltmeter supplies 3V for a full scale reading to the voltmeter circuitry. In the PNP position Q601 and Q602 operate as an inverter having unity gain. In the NPN position the inverter is by-passed and the voltage from the attenuator is applied to the differential pair Q603 and Q604. Q605 is the second stage of amplification and negative feedback is provided by the gain determining resistors R613 and R614. The output of this amplifier drives the voltage analog and the voltmeter.

G. CURRENT AMPLIFIER
(Schematic T-5407)

The DC current of the transistor under test is applied to the Current Amplifier through J101. The function of this amplifier is to provide a DC voltage output (referenced floating ground) proportional to the current in the transistor under test. A high degree of linearity is achieved through the use of the differential detector, followed by two amplifier stages, with 100% current feedback. The DC output of the current amplifier is used to supply the control oscillator.

H. CONTROL OSCILLATOR and 150 KHz RECTIFIER
(Schematic T-5408)

The unity gain DC amplifier made up of Q801, Q802 and Q803 serves to isolate the control oscillator from the current amplifier. Diodes CR807, CR808, CR809, and CR810 provide the full wave rectification required to drive the control oscillator. The resultant output of the control oscillator is a 150 KHz carrier whose amplitude is directly proportional to the magnitude of the collector current of the transistor under test. This carrier is transformer coupled to the rectifier circuit made up of Q805, Q806, Q807, CR811 and CR812. The collector current meter calibration is achieved through the adjustment of R823 which is a part of the output load of the 150 KHz rectifier.

I. AMMETER AND BASE SUPPLY
(Schematic C-5409)

The output of the 150 KHz rectifier is applied to both the ammeter and the base supply. Q906, Q907 and Q908 form a DC amplifier which provides the current analog and also drives the front panel current meter. The base supply is a 3 stage

DC amplifier which compares the output of the 150 KHz rectifier to the voltage at the arm of R901, the collector current variable control. The highly filtered output of the base supply board is applied to the base of the transistor under test through the bias selector switch.

J. ISOLATION AMPLIFIER, LOW PASS and BAND PASS FILTERS (Schematic T-5410)

The isolation amplifier is a 3 section feedback amplifier used to achieve a gain of approximately 5 and to provide a low impedance output to drive the two filters. The 20 KHz band pass filter passes the calibrate signal to the AGC detector and AGC driver whose DC output is used to control the gain of the RF amplifier stages in the TYPE 1340 PLUG-IN UNIT. The 7 KHz low pass filter passes the two low frequency side bands into the noise measuring IF channel.

K. NOISE DETECTOR and INTEGRATOR (Schematic T-5411)

The noise detector is a high gain amplifier used to provide full wave detection of the noise signal. This amplifier is basically a three stage feedback amplifier with differential input. The output current of both of the push-pull transistors is monitored, which provides the full wave detection. The noise integrator is a high gain operational amplifier connected for current sink input, utilizing an RC network for the gain determinant.

L. LOG CONVERTER and OUTPUT AMPLIFIER (Schematic T-5412)

The log converter is an operational amplifier which is almost identical to the integrator. Actual use in the circuit is the same with the exception that the gain determinate is a log element. The output amplifier is a DC amplifier which provides offset capability required for proper noise figure meter indication.

M. AGC DETECTOR and AGC DRIVER (Schematic T-5413)

The 20 KHz calibrate signal is detected and averaged in the AGC detector. The DC output of this circuitry is compared to a Zener diode reference in the AGC driver. The output of the AGC driver which is monitored by the front panel AGC voltage meter is used to control the gain of the RF stages in the TYPE 1340 PLUG-IN UNIT. This closed loop provides the automatic gain control required to achieve noise figure calibration.

SECTION 5

MAINTENANCE AND CALIBRATION

A. GENERAL

1. The Model 340 including the PLUG-IN UNIT uses semiconductor components throughout to reduce preventive maintenance to a minimum.

2. It is recommended that the instrument be opened up only after normal operation checks indicate the necessity of doing so. Servicemen are cautioned not to change calibration adjustments unless it has been firmly established that adjustment is required.

3. Main power should be turned off when connecting or disconnecting the printed circuit assemblies to avoid damaging semiconductor components through the transient voltages thus created. Care should be taken to insure proper alignment of the printed circuit assemblies when replacing them in their sockets.

4. If servicing is required, it is advisable to consult the warranty page for in warranty servicing information.

B. NORMAL OPERATION

1. Gate Bias Loop

With no device in the test socket, the shield cover closed, and the BIAS selector switch in the GATE BIAS VOLTAGE position, the ranges of the voltmeter, the meter itself and the $\pm$ 15V range of the concentric control can be checked. The meter should read center scale in the center ground position of the BIAS selector switch. In the COLLECTOR/DRAIN CURRENT position of the BIAS selector switch, the Gate Bias Voltage Meter should read approximately 10V (positive in NPN and negative in PNP).

2. Ammeter

The fastest and easiest method of checking for normal operation of the ammeter is to check with a transistor in the socket and the BIAS selector switch in the COLLECTOR/DRAIN CURRENT position. Two things can be checked in this manner. With the ammeter reading a particular amount, there should be little change in the scale reading when the range switch is changed through all the positions. With the current control fully clockwise, the ammeter should read slightly above full scale. If the ammeter functions in the way described, operation is normal.

3. Voltmeter

The voltmeter and the collector voltage supply can be readily checked with or without a transistor in the test socket. With the COLLECTOR/DRAIN VOLTAGE switch in the 100 position, the voltmeter should read approximately zero with the concentric control fully counterclockwise and should read slightly more than 60V with the concentric control fully clockwise.

4. NOISE FIGURE Meter and AGC VOLTAGE Meter

Both of these meters may read with the shield cover open, whether a transistor is in the socket or not. With the cover open, the meter readings are meaningless. In normal operation, with a transistor in the test socket, the shield cover closed, and the BASE RESISTANCE switch in the fully clockwise position, the meter readings will show a variation with a change in the capacity control. To obtain proper noise figure readings, the capacity control must be tuned for minimum AGC voltage and maximum noise figure.

C. REMOVAL OF THE COVERS

Either the top or the bottom of the MODEL 340 may be removed for access to the inside of the equipment. No other screws on the front or sides should be loosened or removed.

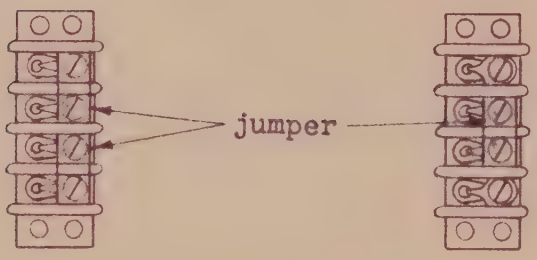
D. CHANGING THE INPUT VOLTAGE

This instrument has been designed to operate from either a 117V or a 234V AC power source. The plate on the rear, near the power cord, indicates the voltage at which the instrument should be operated. If the input voltage must be changed, the procedure given below should be followed:

1. Remove the bottom cover

2. Change the transformer primary connections by moving the jumpers on the four terminal barrier strip, which is located

near the power transformer. Connect the jumpers as indicated on FIGURE 5-1.



For 117 V.A.C.operation For 234 V.A.C.operation

FIGURE 5-1. INPUT VOLTAGE BARRIER STRIP

3. Reverse the plate on the rear of the instrument to indicate the new voltage connections.

4. Replace the bottom cover.

E. DETAILED CALIBRATION

Precision value resistors have been used in many areas in the design of this equipment to eliminate the need for periodic adjustment. There are some instances where circuits have been set up through factory selection of resistance values. These circuits normally require no readjustment.

The following procedure will cover the circuitry which is normally calibrated by screwdriver adjustment:

1. Front panel meter mechanical zero

   All five front panel meters should be adjusted for zero reading with the equipment turned off. Note that the Gate/Bias Voltage Meter is a center zero meter.

2. Collector/Drain Current

   The front panel CURRENT meter is made to agree with a precision external Ammeter through the adjustment of R823, which is located on a printed circuit connector board at the extreme left rear of the equipment.

3. AGC Voltage Calibrate

   a. Remove the TYPE 1340 PLUG-IN UNIT

   Input = 1st pin of Card - or 1st lead 100 uf 25v Cap

   b. Apply a 0.25V ± 1% 20 KHz sine wave signal to the input of the isolation amplifier (Assembly #5331).

   c. Adjust R1311, AGC cal., for center scale reading of the AGC Voltage Meter. This is a reasonably critical adjustment, and it should be noted that small ~~large~~ changes in R1311 will cause the AGC VOLTAGE meter to go from zero reading to full scale reading.

4. Integrator Zero

   a. Remove the integrator, Assembly 5335, and place on the extender board provided.

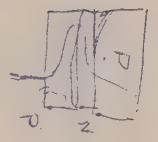
   b. Ground pin 2 of this assembly and adjust R1120, which is located on the plug-in board, for zero volts from pin 9 to ground.

   c. Replace the integrator assembly in its normal position.

5. Log Converter Zero Assy 5336?

   R1204 located on the log converter plug-in board, is adjusted for zero V output, using same procedure as for the integrator.

" REMOVE MHz PLUG-IN UNIT "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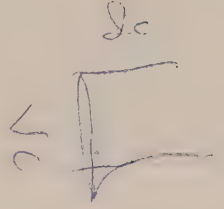

y.c
y.c

.186 X 1000 = 186

600Ω TERM

6. Noise Cal. METER MULT DB HAS TO BE IN "0"

   a. Apply 186 microvolts per root cycle of white noise from a white noise source such as the QTL MODEL 420, to pin 3 of the isolation amplifier. 5331

   b. Adjust R1107, noise cal., for -2.5V DC from pin 9 of the integrator (Assembly 5335) to ground.

7. Noise Analog Adjustment

   a. Adjust the level of the white noise generator, attached to pin 3 of the Isolation Amplifier, to 2V DC from pin 4 of the Output Amplifier (Assembly 5337) to ground.

   b. Adjust R1227 for 20 db NOISE FIGURE meter reading.

8. Output Amplifier

Remove Plug-in

   a. Remove the output amplifier board (Assembly 5337) and place it on the extender board to allow adjustments to be made.

   b. Reset the level of the white noise source to precisely 186 microvolts per root cycle.

Double Check — OR 600 MV

   c. Adjust R1225 for 20 db noise figure. CCW OR 10 db

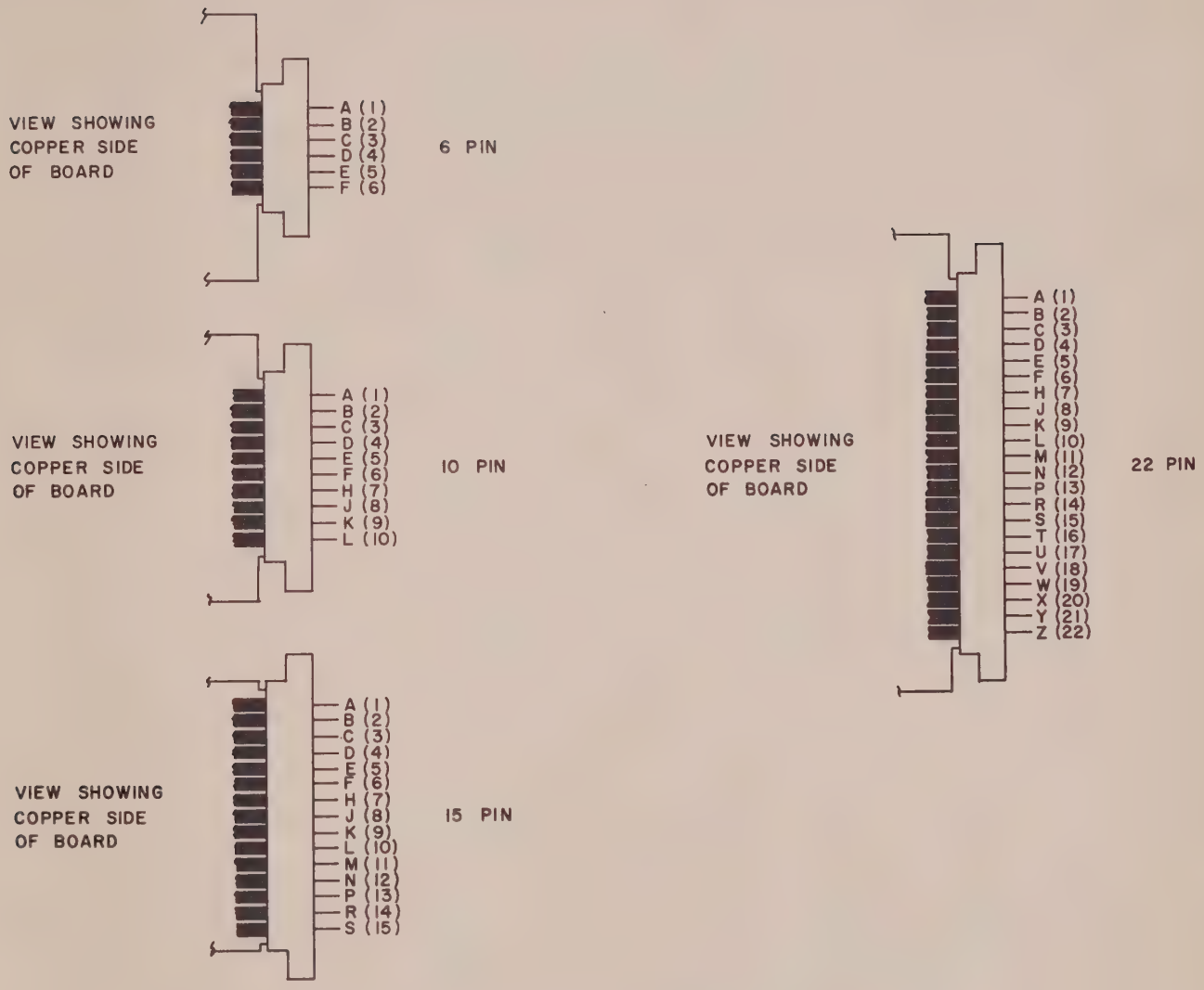
   d. Reduce the level from the white noise source by precisely 10 to 1 (18.6 microvolts per root cycle).

LOWER POT ON BOARD → OR 10 db,

   e. Adjust R1217 for zero db noise figure. CW Range

   f. Repeat adjustments in c, d and e until proper adjustment has been achieved for both the zero and 20 db meter readings.

.185
X1000
.85000



PRINTED CIRCUIT BOARD CONNECTOR LUG IDENTIFICATION

SCHEMATIC LEGEND

k = 1000

⊘ = Screw Driver Adjustment

▭ = Front Panel Control

* = Factory Select

Unless Otherwise Specified:

All Resistances in Ohms

All Resistors 1/2 Watt

All Capacitances in Microfarads

SEMICONDUCTOR LEGEND

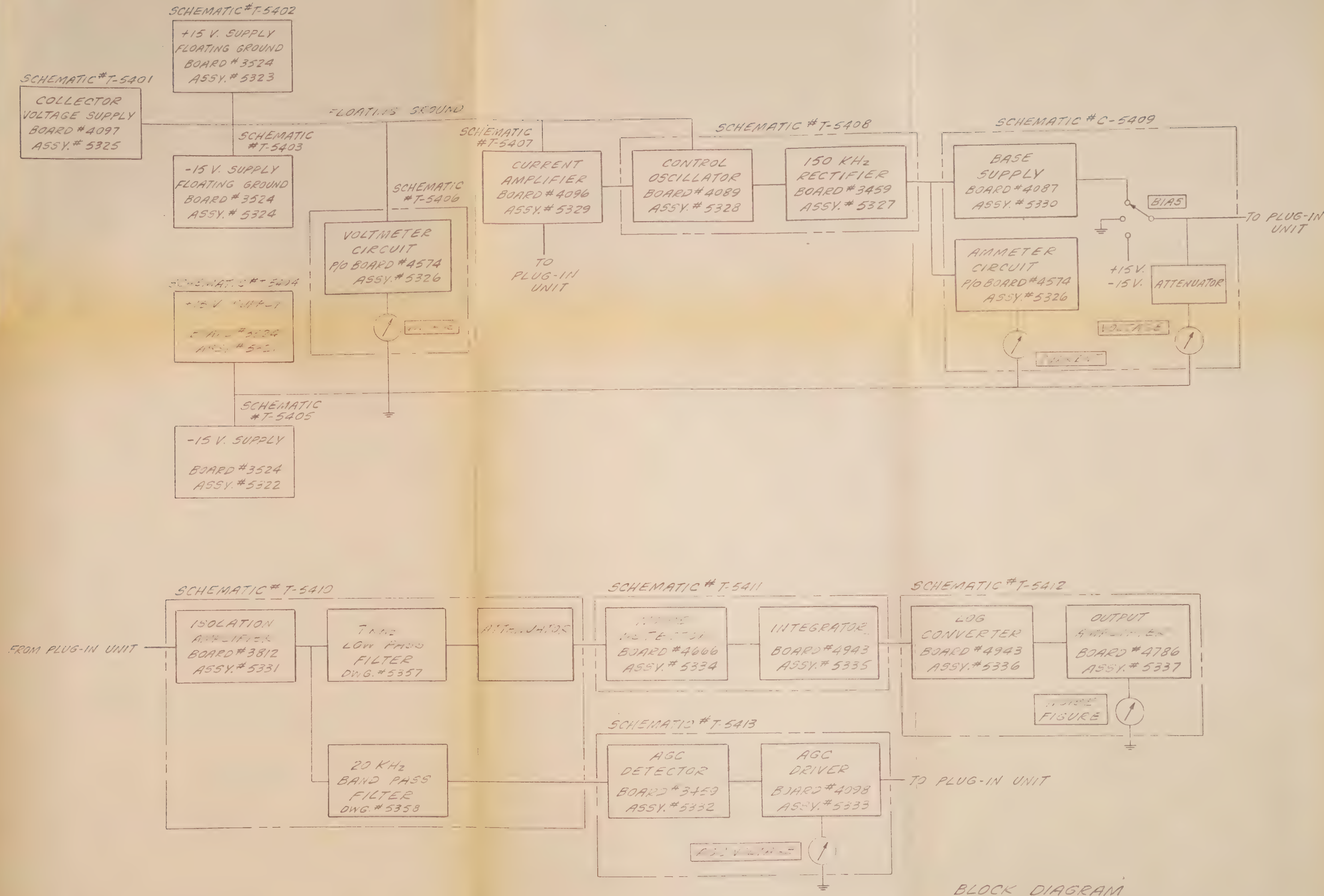
Changes and improvements in the semiconductor products available for commercial use necessitate type changes from time to time. To eliminate confusion and costly paperwork, many of these changes will be covered in the following legend. The purpose of this legend is to acknowledge the fact that the type number on a semiconductor found in a piece of equipment will not necessarily correspond with the type number given on the schematic diagram.

The legend is not intended to be an interchangeability list although in many cases good quality components* within a given category may be substituted with acceptable results. Normally, replacements should be made using components having the same type number as the component being replaced.

Those components bearing an asterisk on the schematic diagram are factory selected components and should be obtained from Quan-Tech Laboratories.

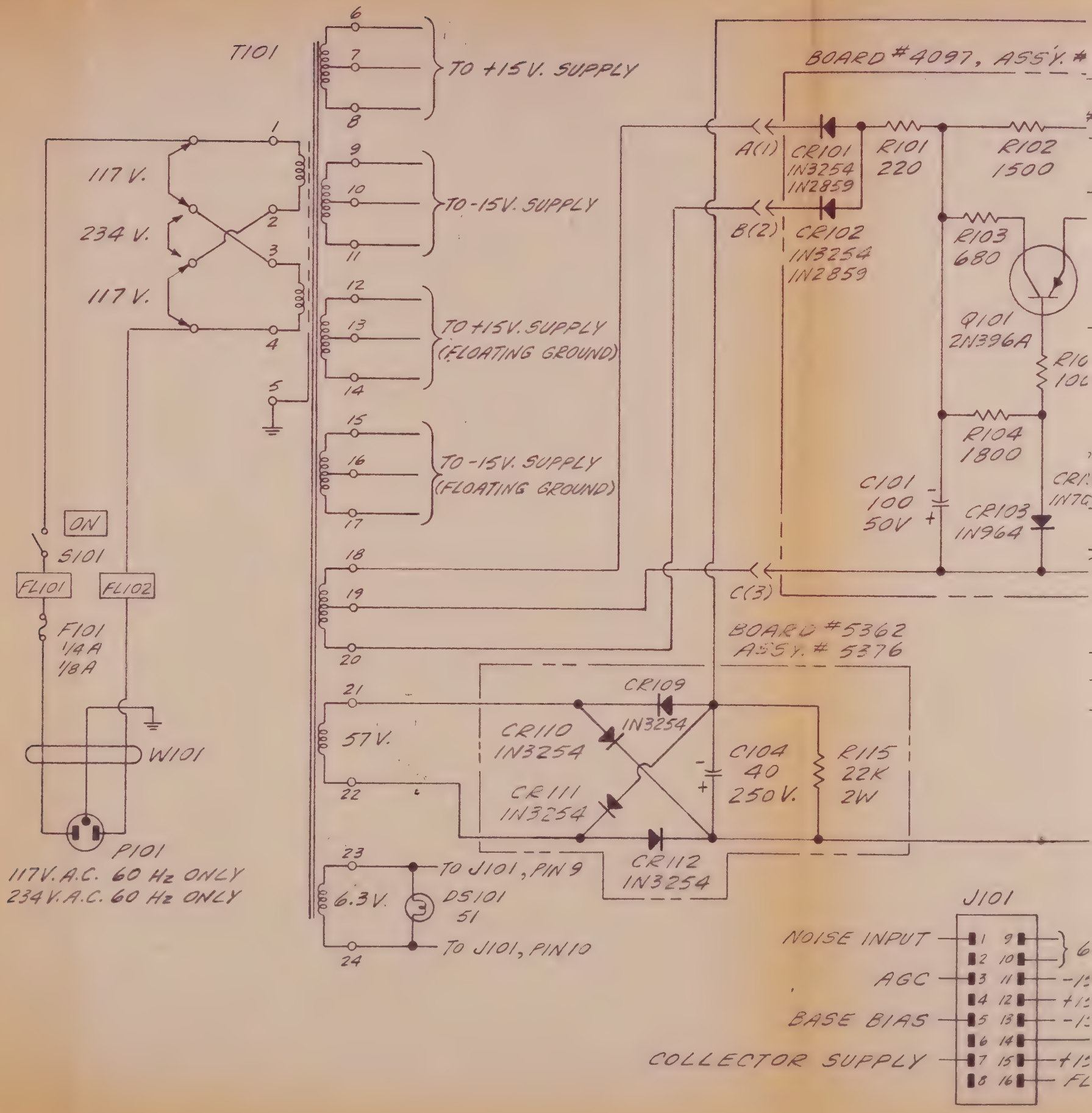
*It should be noted that the incoming inspection procedure followed at Quan-Tech Laboratories includes noise screening on most semiconductors.

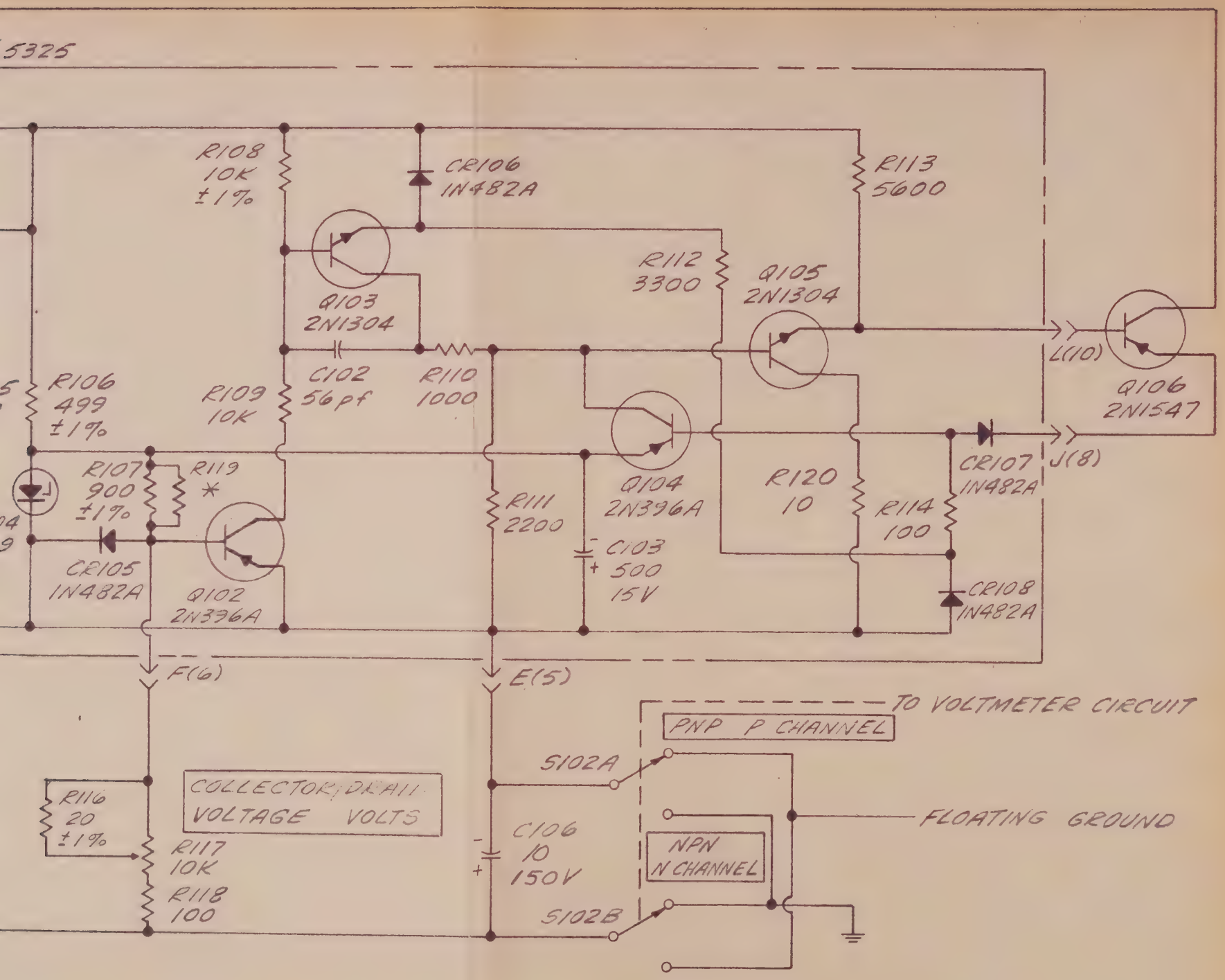
TYPE # ON SCHEMATIC	TYPE # IN EQUIPMENT
T1480	2N1613
T1494	2N1613
1N703	1N748
1N709	1N753
1N2859	1N3253, 1N3254
1N2862	1N3254
2N396A	4JX1G759, 4JX1D653, 2N3644
2N414	2N396A, 4JX1G759, 4JX1D653, 2N3644
2N929	220N2, A642, 2N3566, A322, A324
2N1515	2N3644
2N1613	2N3566
2N2219	220N2, A642, 2N3566, A322, A324
2N2603	2N3250
2N3250	2N3644
2N270	2N3644
2N1306	2N3566
2N1304	2N3566


SCHEMATIC #T-5402
+15 V. SUPPLY FLOATING GROUND BOARD #3524 ASSY. #5323
SCHEMATIC #T-5401
COLLECTOR VOLTAGE SUPPLY BOARD #4097 ASSY. #5325
FLOATING GROUND
SCHEMATIC #T-5403
-15 V. SUPPLY FLOATING GROUND BOARD #3524 ASSY. #5324
SCHEMATIC #T-5406
VOLTMETER CIRCUIT P/O BOARD #4574 ASSY. #5326
SCHEMATIC #T-5404
SCHEMATIC #T-5405
-15 V. SUPPLY BOARD #3524 ASSY. #5322
SCHEMATIC #T-5407
CURRENT AMPLIFIER BOARD #4096 ASSY. #5329
TO PLUG-IN UNIT
SCHEMATIC #T-5408
CONTROL OSCILLATOR BOARD #4089 ASSY. #5328
150 KH2 RECTIFIER BOARD #3459 ASSY. #5327
SCHEMATIC #C-5409
BASE SUPPLY BOARD #4087 ASSY. #5330
AMMETER CIRCUIT P/O BOARD #4574 ASSY. #5326
BIAS
+15V.
-15V.
ATTENUATOR
TO PLUG-IN UNIT
FROM PLUG-IN UNIT
SCHEMATIC #T-5410
ISOLATION AMPLIFIER BOARD #3812 ASSY. #5331
LOW PASS FILTER DWG. #5357
20 KH2 BAND PASS FILTER DWG. #5358
SCHEMATIC #T-5411
INTEGRATOR BOARD #4943 ASSY. #5335
SCHEMATIC #T-5412
LOG CONVERTER BOARD #4943 ASSY. #5336
OUTPUT BOARD #4786 ASSY. #5337
FIGURE
SCHEMATIC #T-5413
AGC DETECTOR BOARD #3459 ASSY. #5332
AGC DRIVER BOARD #4098 ASSY. #5333
TO PLUG-IN UNIT

BLOCK DIAGRAM
R.F. TRANSISTOR NOISE ANALYZER
MODEL 340

C-5400-A


T101
6
7
8
TO +15 V. SUPPLY
9
10
11
TO -15V. SUPPLY
12
13
14
TO +15V. SUPPLY
(FLOATING GROUND)
15
16
17
TO -15V. SUPPLY
(FLOATING GROUND)
18
19
20
21
57 V.
22
23
6.3 V.
24
TO J101, PIN 9
TO J101, PIN 10
DS101
51
1
117 V.
2
234 V.
3
117 V.
4
5
ON
S101
FL101
FL102
F101
1/4A
1/8A
W101
P101
117V. A.C. 60 Hz ONLY
234V. A.C. 60 Hz ONLY
BOARD #4097, ASS'Y. #
A(1)
CR101
IN3254
IN2859
R101
220
R102
1500
B(2)
CR102
IN3254
IN2859
R103
680
Q101
2N396A
R10
10C
R104
1800
C101
100
50V
CR103
IN964
CR1
IN7C
C(3)
BOARD #5362
ASS'Y. # 5376
CR109
IN3254
CR110
IN3254
CR111
IN3254
CR112
IN3254
C104
40
250V.
R115
22K
2W
J101
NOISE INPUT
AGC
BASE BIAS
COLLECTOR SUPPLY
1 9
2 10
3 11
4 12
5 13
6 14
7 15
8 16
6
-1
+1
-1
+1
FL



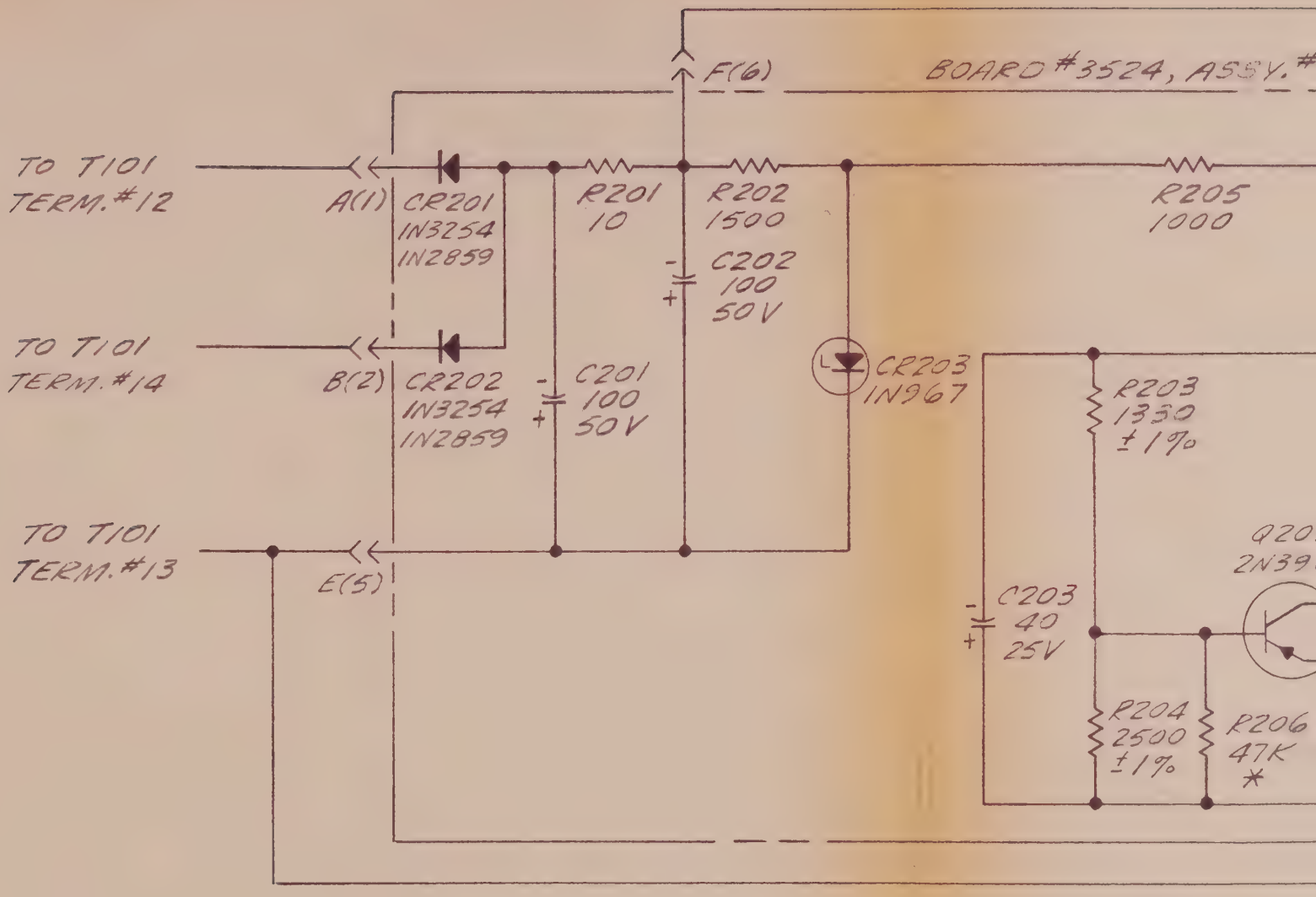
.3V

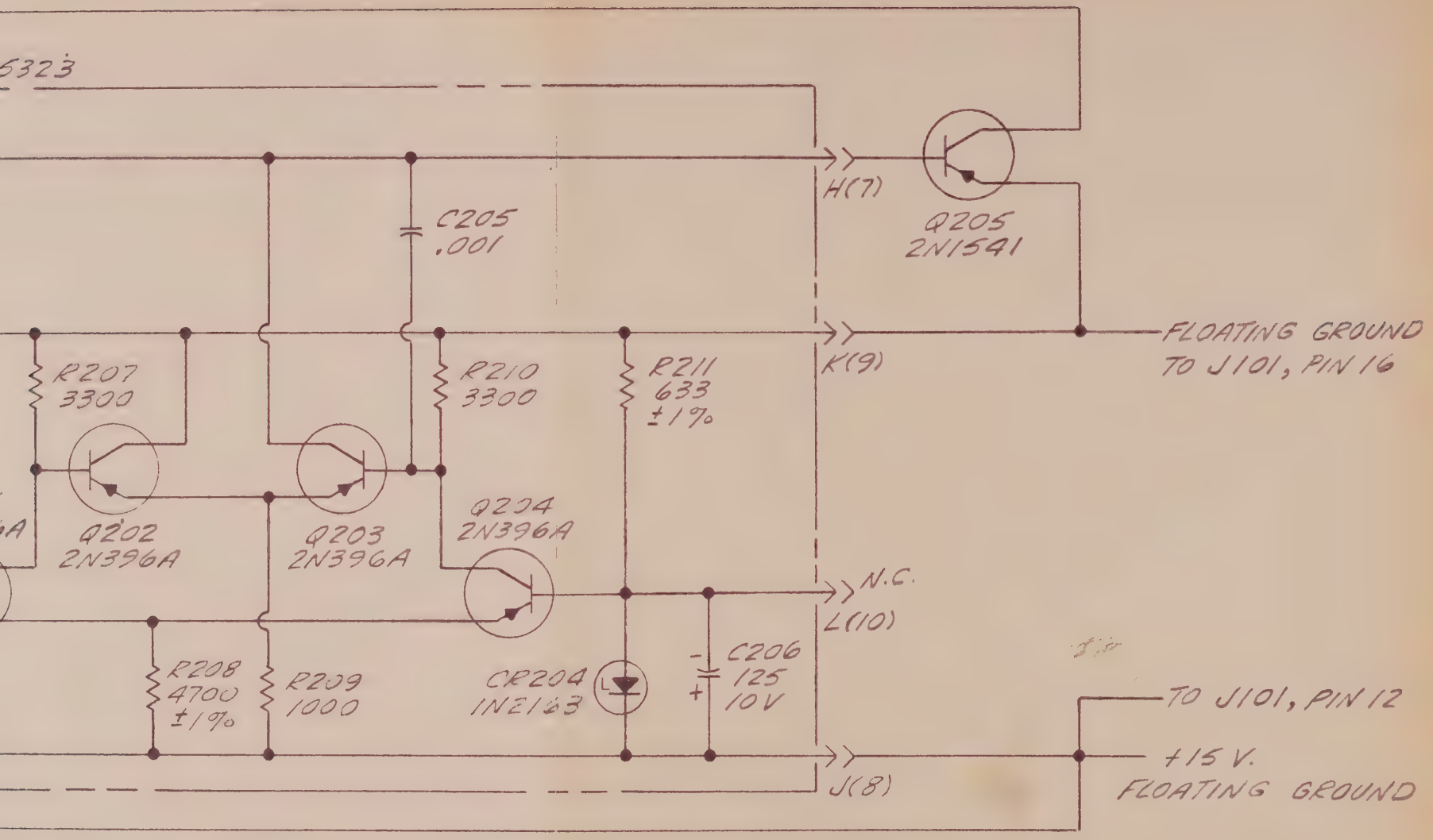
V., FLOATING GROUND
V., FLOATING GROUND
V.

V.
OATING GROUND

SCHEMATIC
POWER INPUT & COLLECTOR
VOLTAGE SUPPLY
MODEL 340

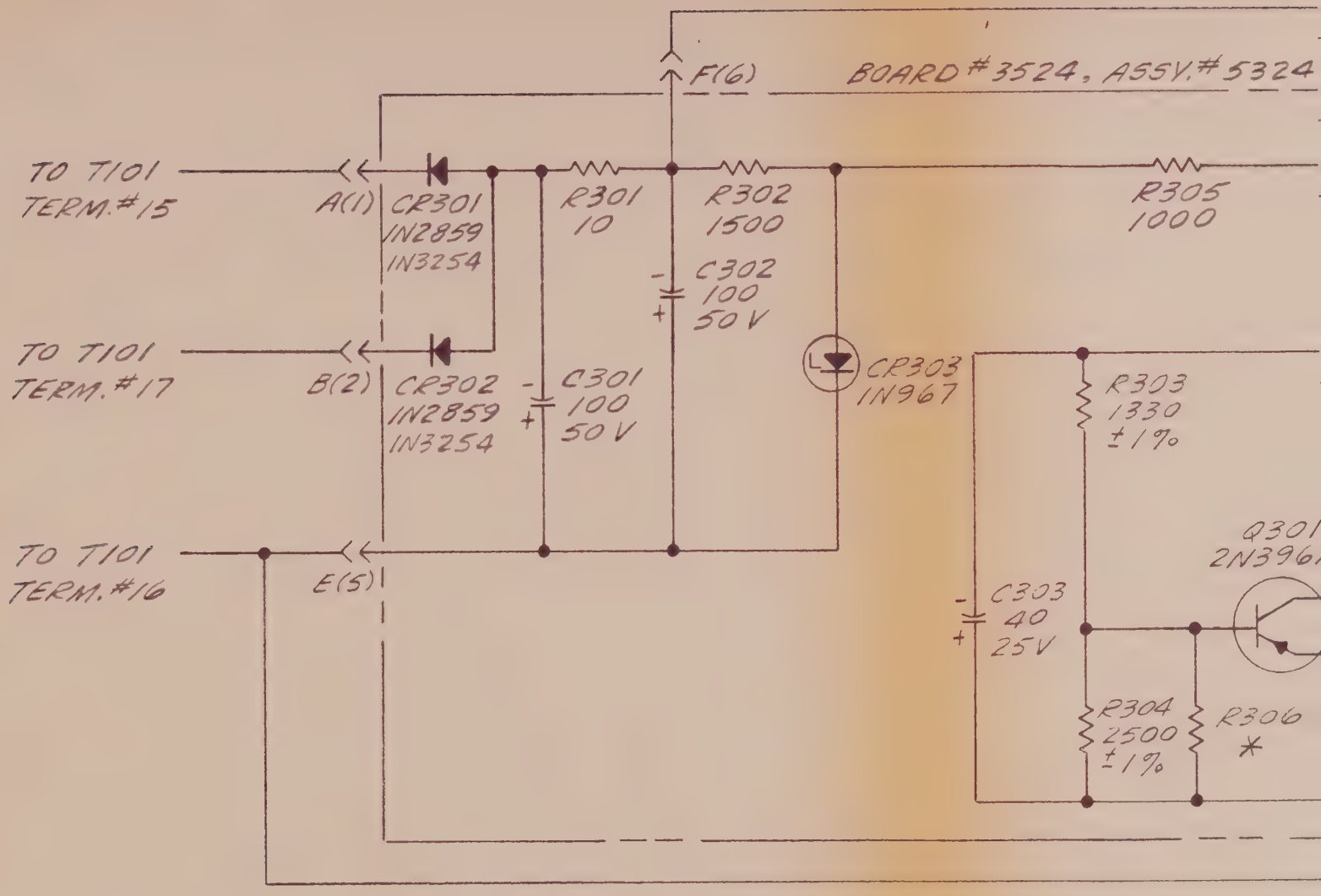
T-5401-D

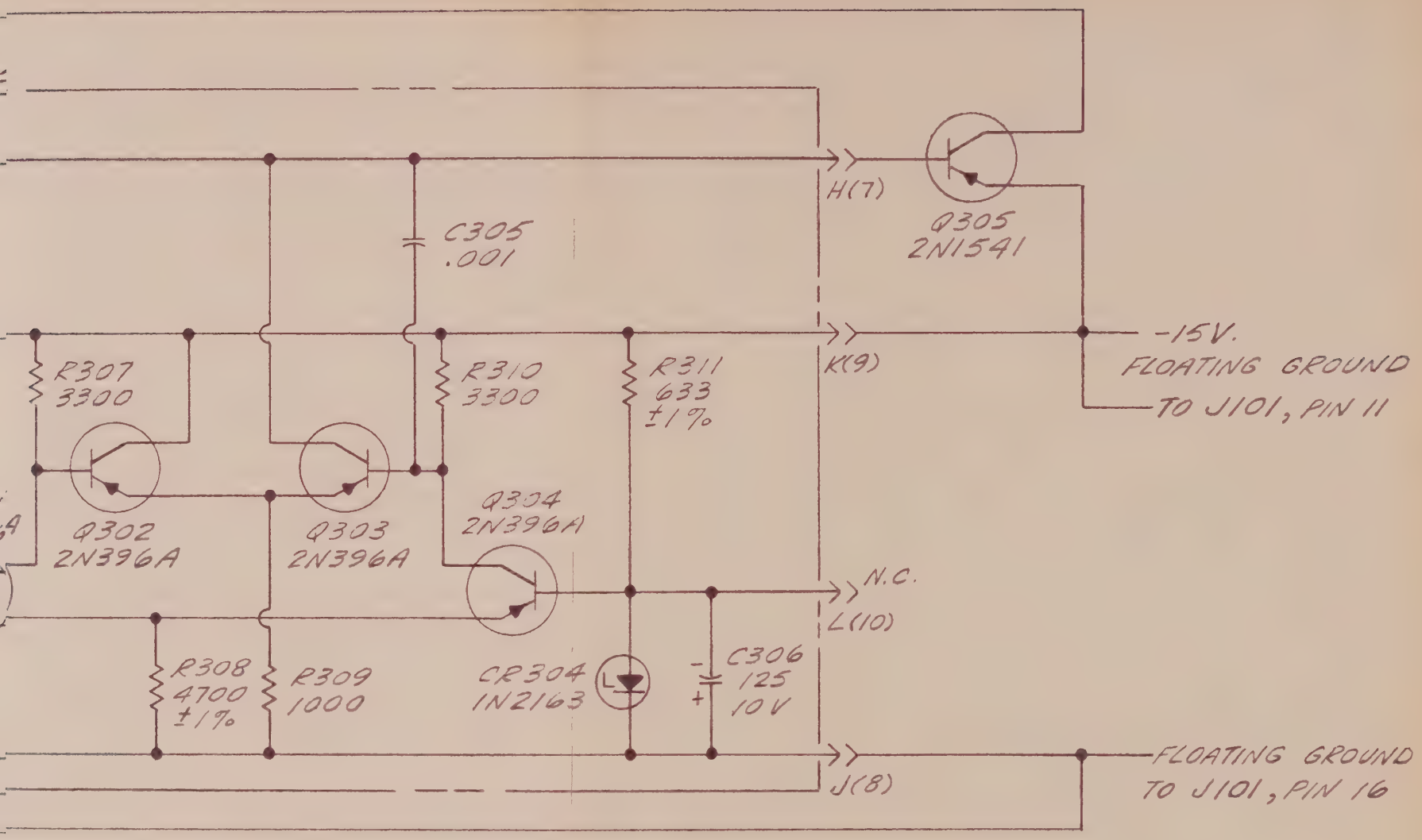

F(6)
BOARD #3524, ASSY. #
TO T101
TERM. #12
A(1)
CR201
IN3254
IN2859
R201
10
R202
1500
R205
1000
C202
100
50V
TO T101
TERM. #14
B(2)
CR202
IN3254
IN2859
C201
100
50V
CR203
IN967
R203
1350
±1%
TO T101
TERM. #13
E(5)
C203
40
25V
Q20
2N39
R204
2500
±1%
R206
47K
*



SCHEMATIC
+15 VOLT SUPPLY (FLOATING GROUND)
MODEL 340

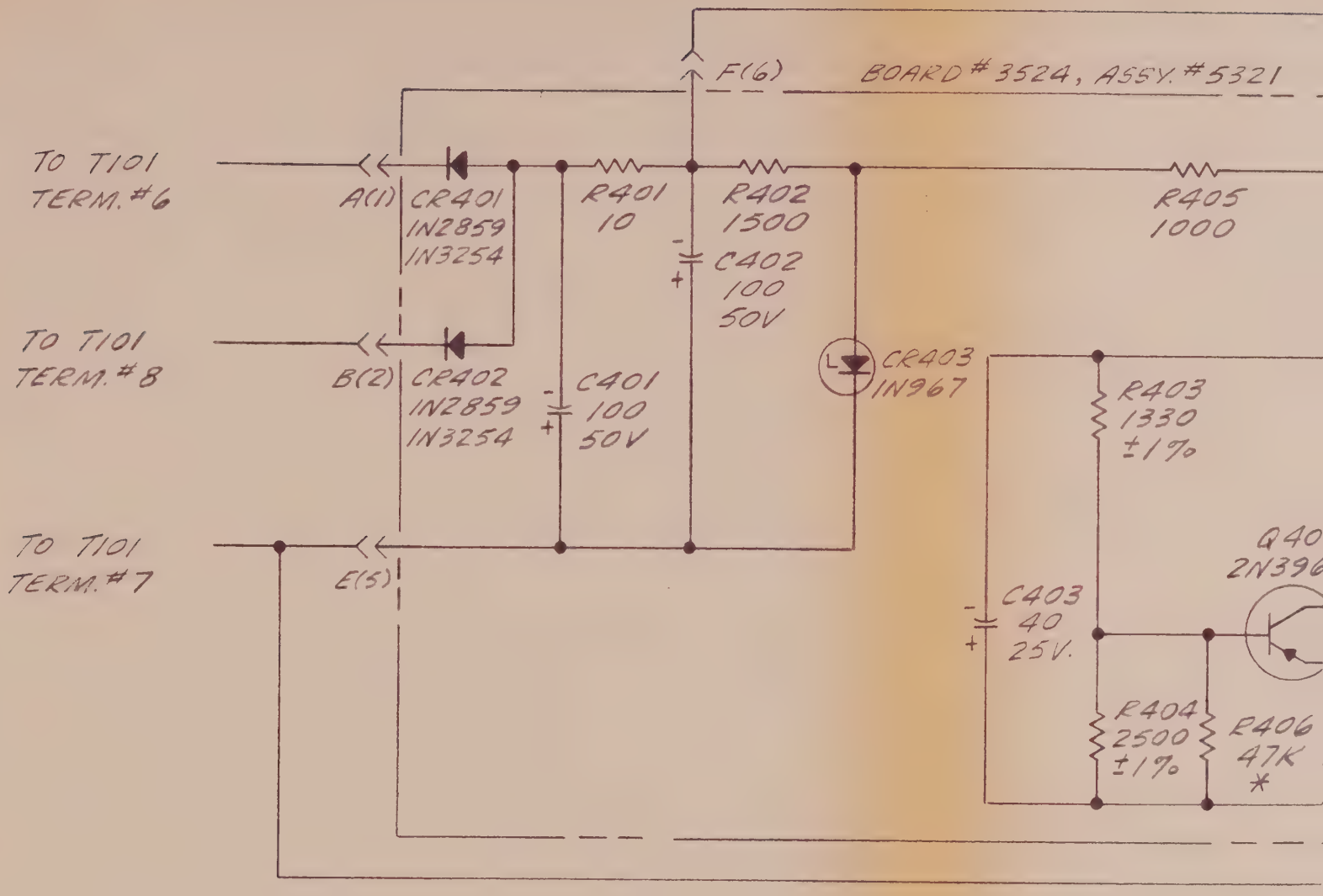
T-5402-B

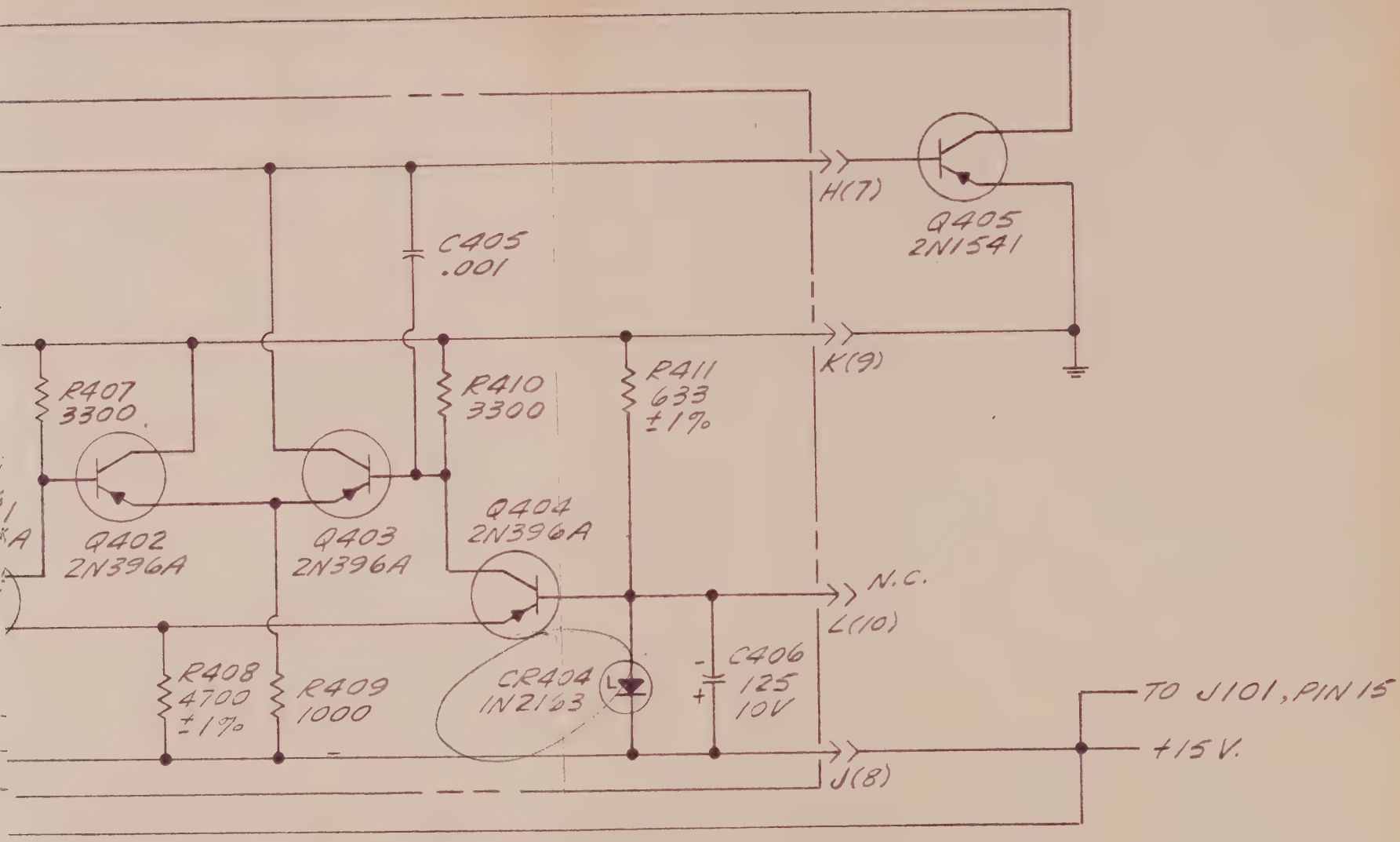

F(6)
BOARD #3524, ASSY. #5324
TO T101
TERM. #15
A(1)
CR301
IN2859
IN3254
R301
10
R302
1500
R305
1000
C302
100
50 V
TO T101
TERM. #17
B(2)
CR302
IN2859
IN3254
C301
100
50 V
CR303
IN967
R303
1330
±1%
TO T101
TERM. #16
E(5)
C303
40
25V
Q301
2N396
R304
2500
±1%
R306
*



SCHEMATIC
-15 VOLT SUPPLY (FLOATING GROUND)
MODEL 340

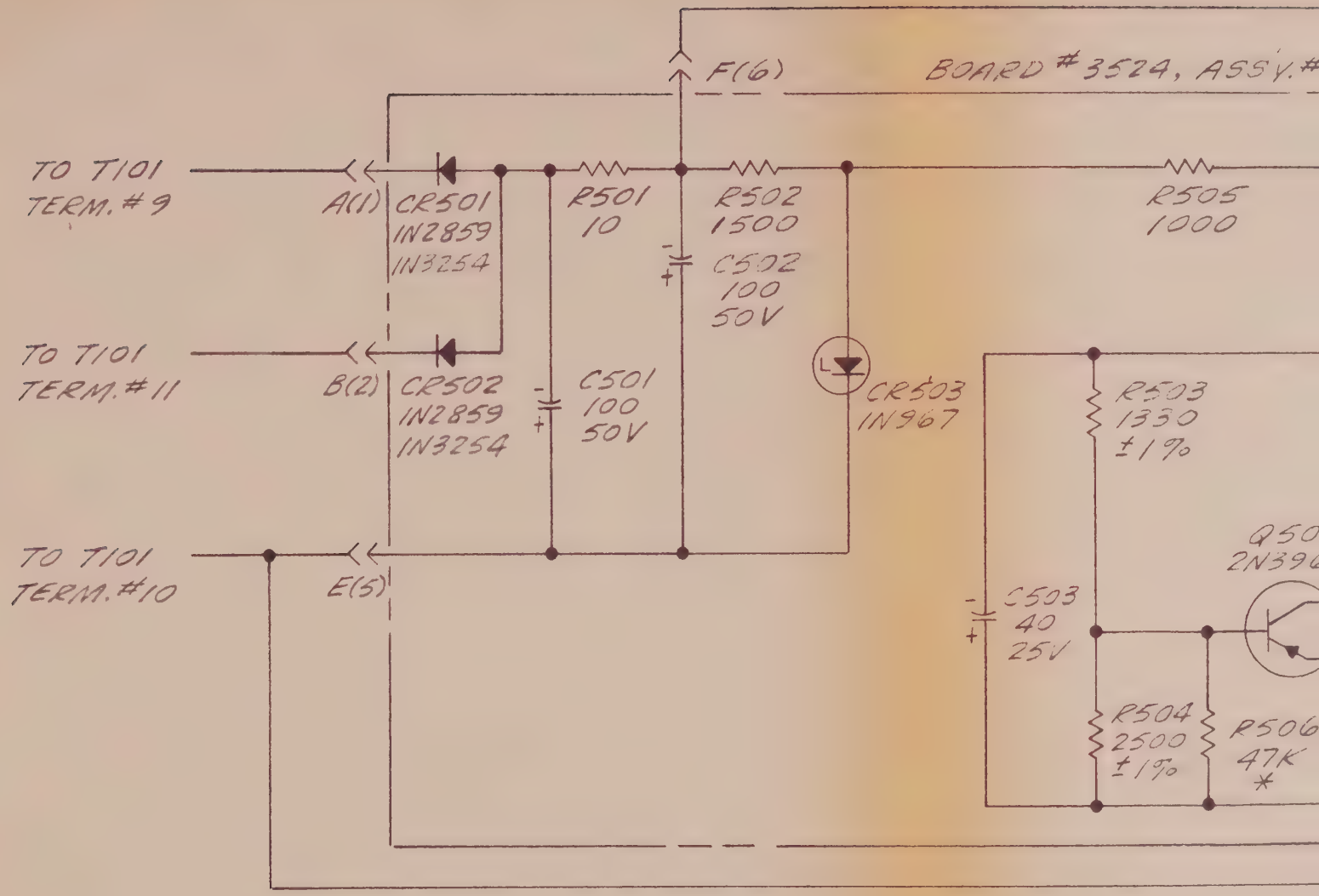
T-5403-B

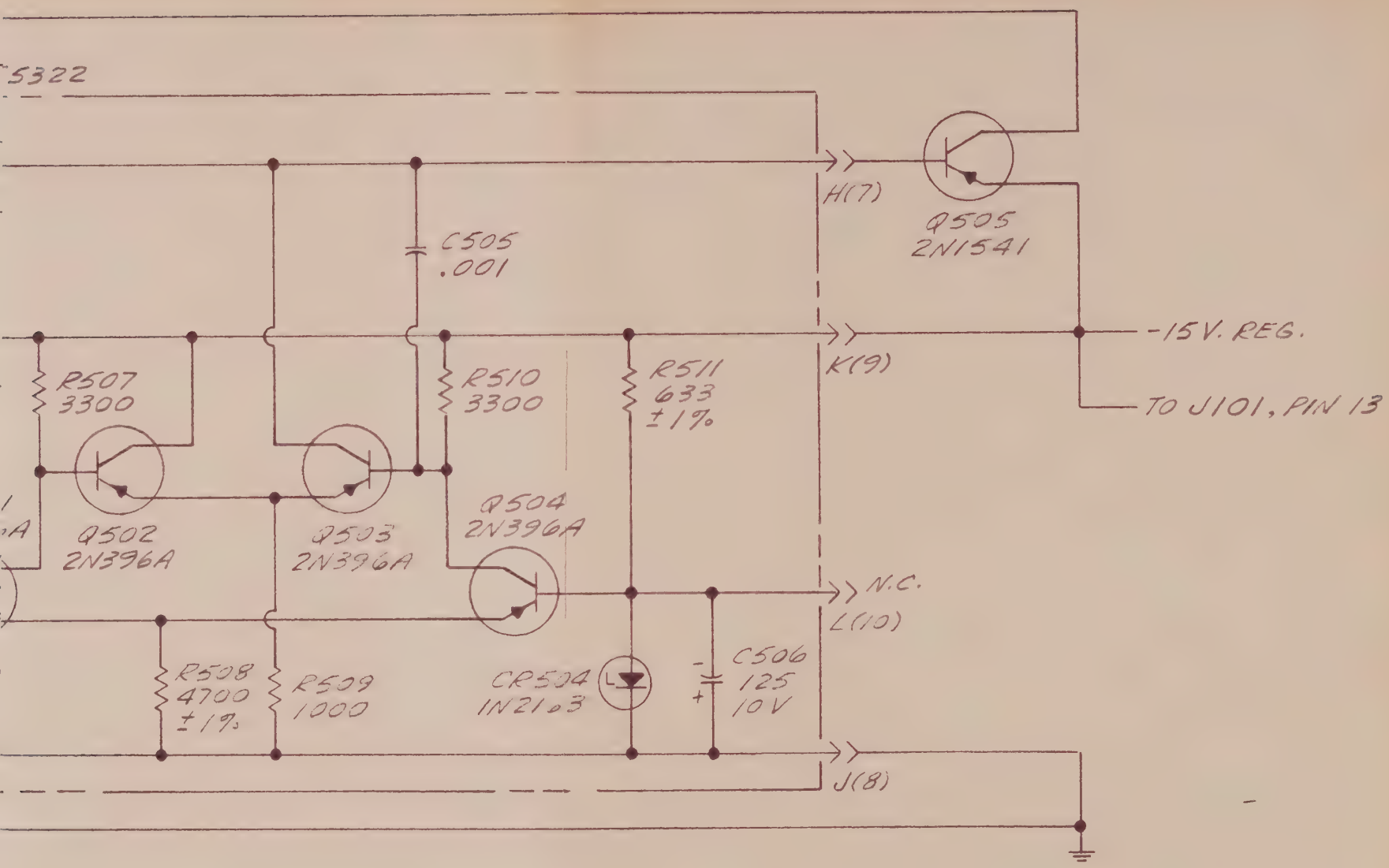

F(6)
BOARD # 3524, ASSY. # 5321
TO T101
TERM. #6
A(1)
CR401
IN2859
IN3254
R401
10
R402
1500
C402
100
50V
R405
1000
TO T101
TERM. #8
B(2)
CR402
IN2859
IN3254
C401
100
50V
CR403
IN967
R403
1330
±1%
TO T101
TERM. #7
E(5)
C403
40
25V.
R404
2500
±1%
R406
47K
*
Q40
2N396



SCHEMATIC
+15 VOLT SUPPLY
MODEL 340

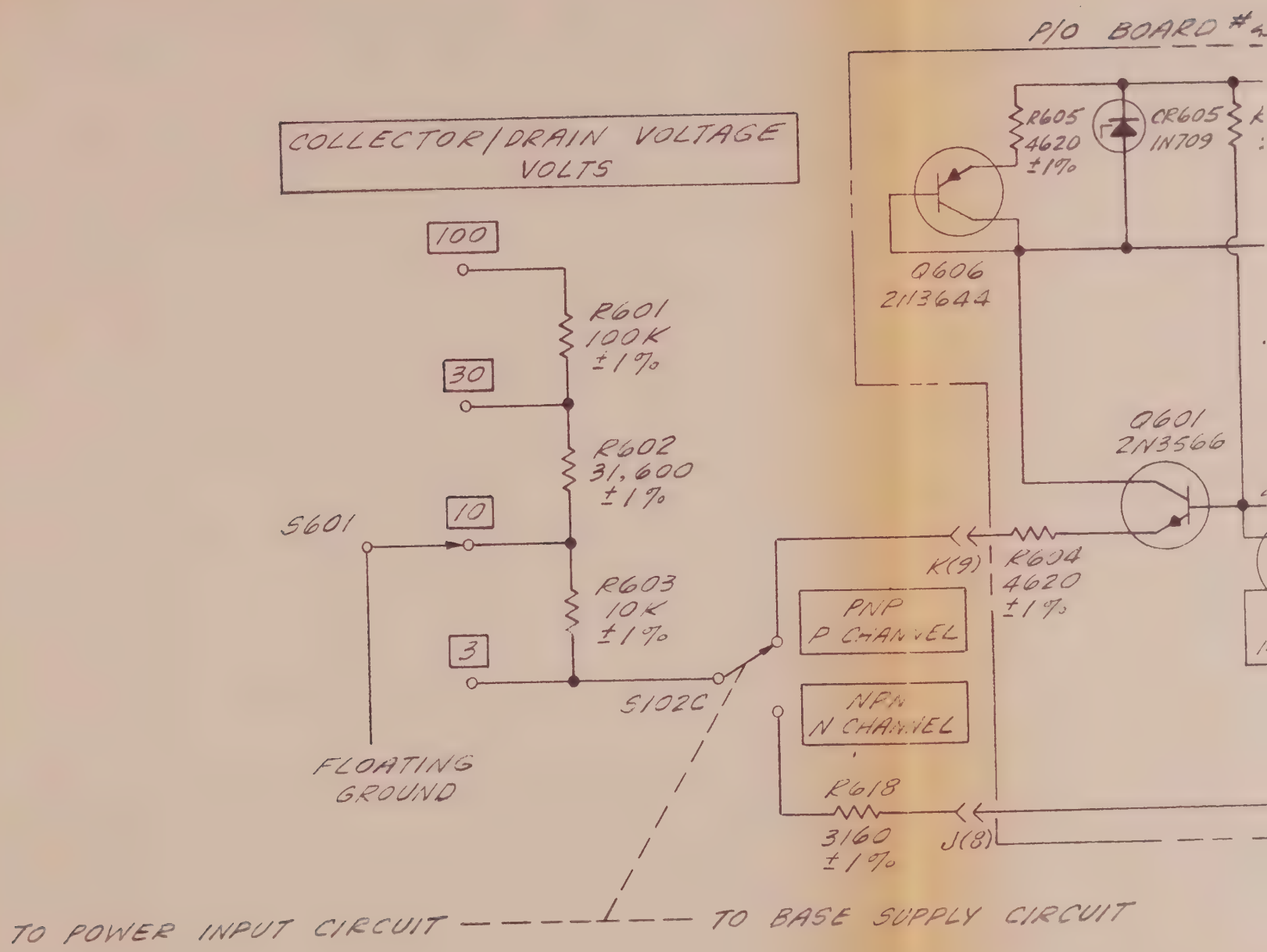
T-5404-B

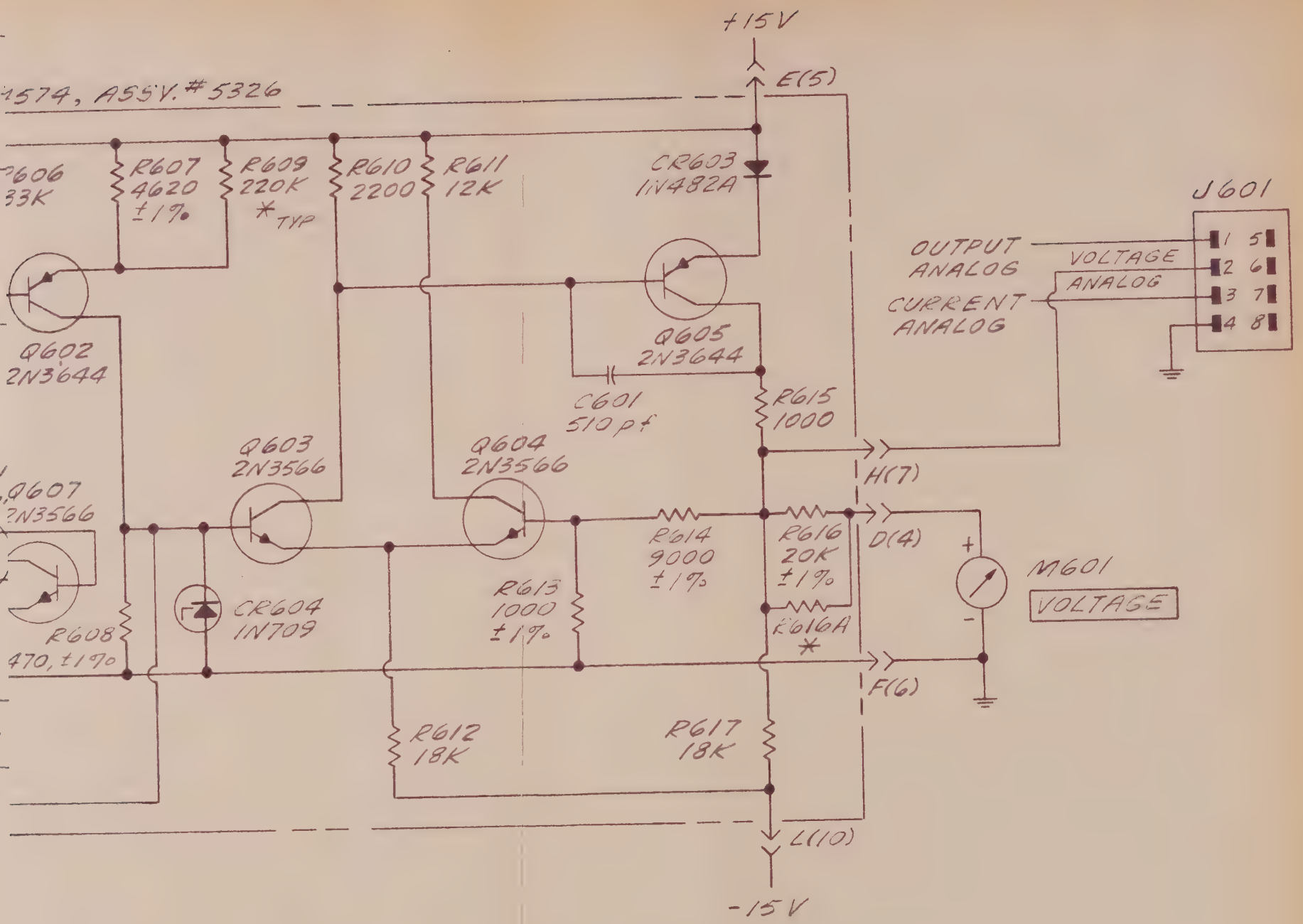

F(6)
BOARD #3524, ASS'Y.#
TO T101
TERM. #9
A(1)
CR501
IN2859
IN3254
R501
10
R502
1500
C502
100
50V
R505
1000
TO T101
TERM. #11
B(2)
CR502
IN2859
IN3254
C501
100
50V
CR503
IN967
R503
1350
±1%
TO T101
TERM. #10
E(5)
C503
40
25V
R504
2500
±1%
R506
47K
*



SCHEMATIC
-15 VOLT SUPPLY
MODEL 340

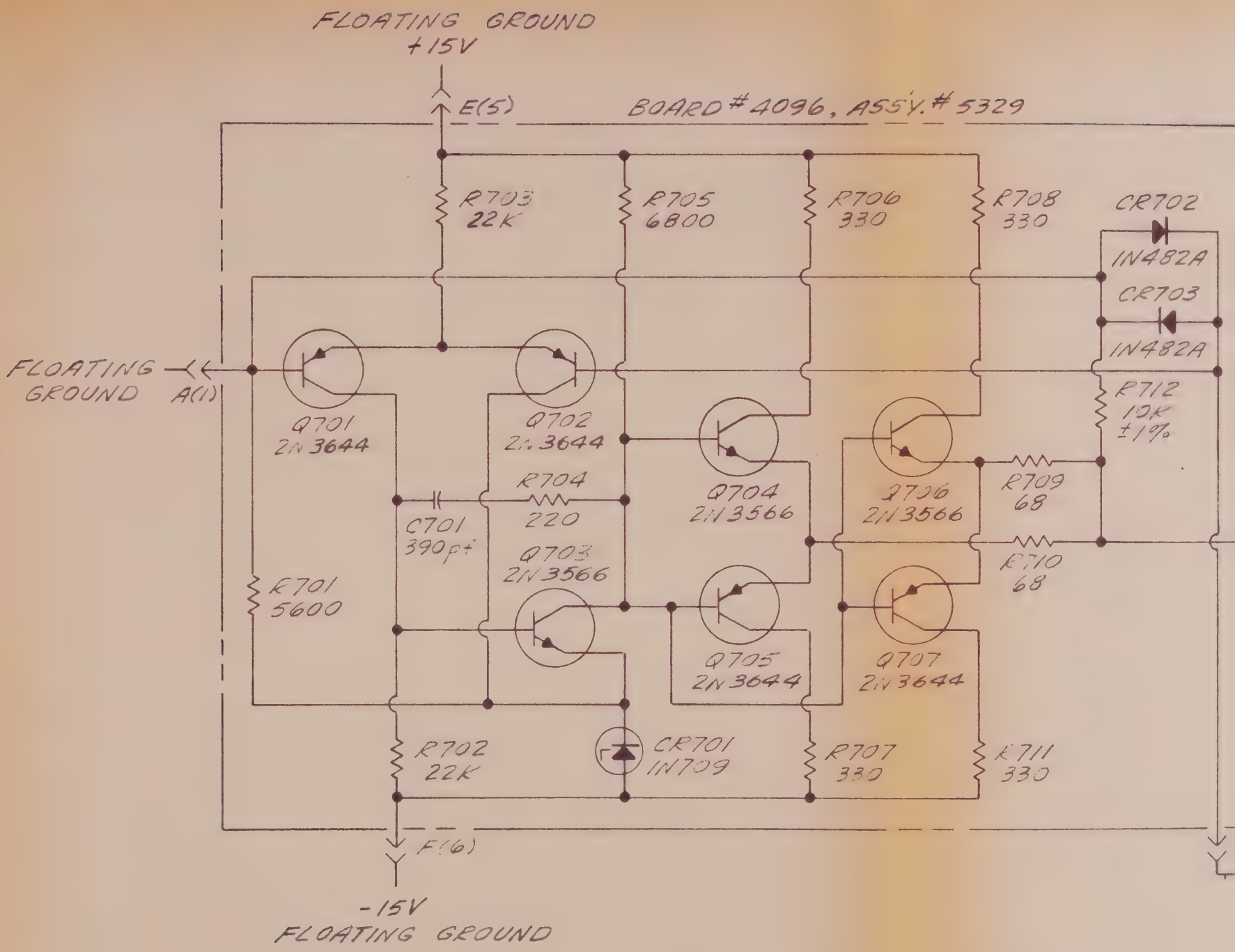
T-5405-B

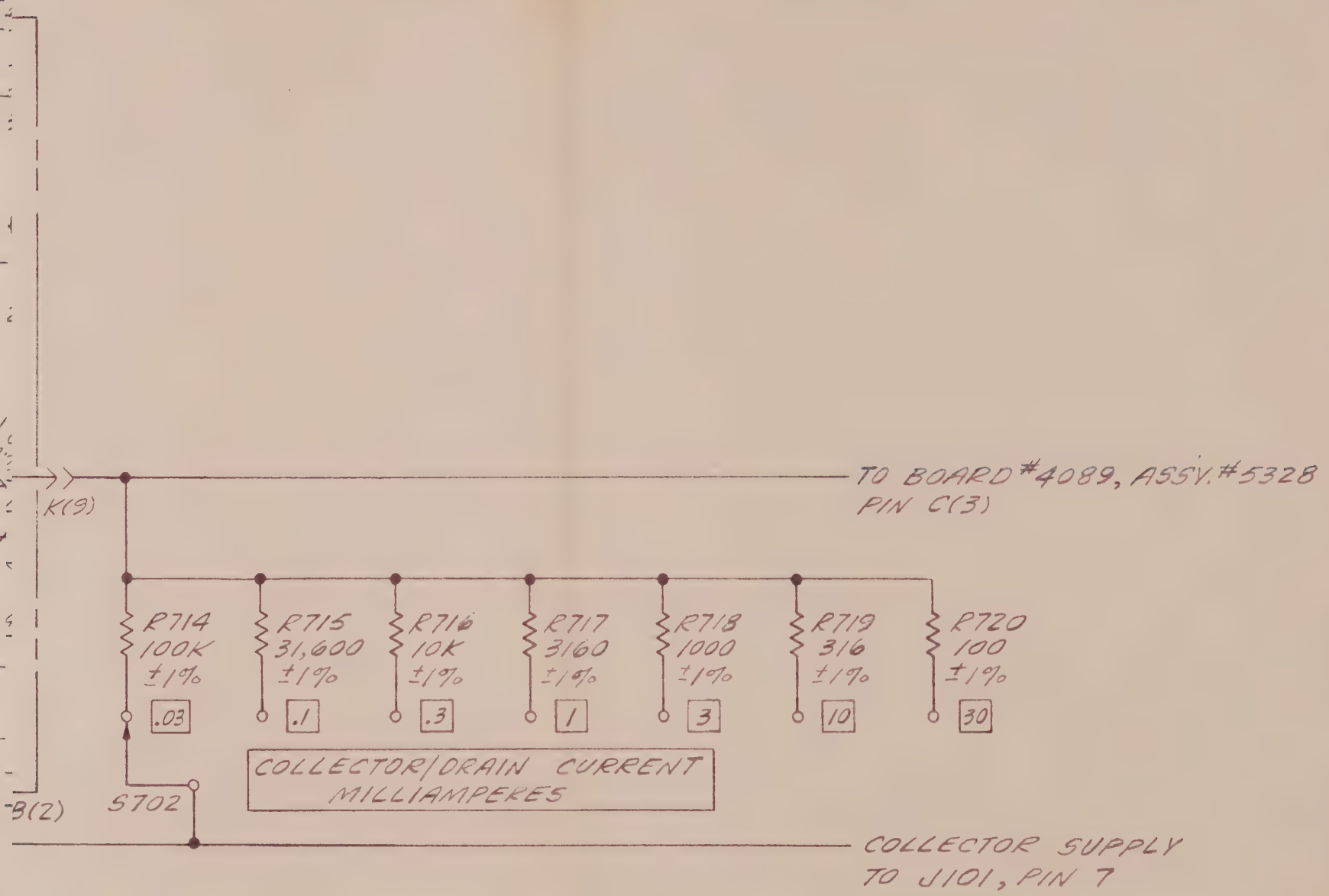

P/O BOARD #
COLLECTOR/DRAIN VOLTAGE VOLTS
100
30
10
3
S601
R601 100K ±1%
R602 31,600 ±1%
R603 10K ±1%
FLOATING GROUND
S102C
R605 4620 ±1%
CR605 IN709
Q606 2N3644
Q601 2N3566
K(9)
R604 4620 ±1%
PNP P CHANNEL
NPN N CHANNEL
R618 3160 ±1%
J(8)
TO POWER INPUT CIRCUIT
TO BASE SUPPLY CIRCUIT



SCHEMATIC
VOLTMETER CIRCUIT
MODEL 340

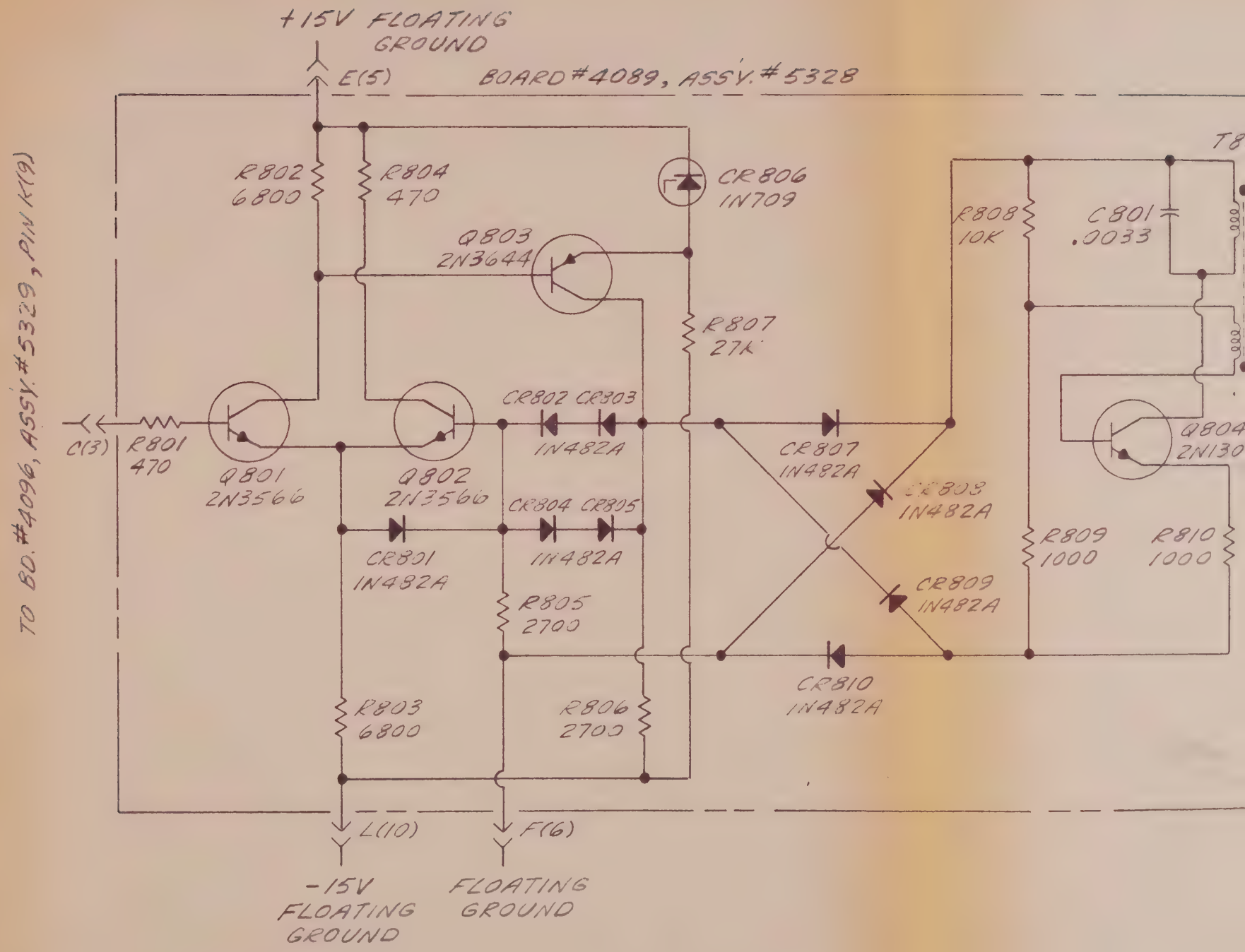
T-5406-C

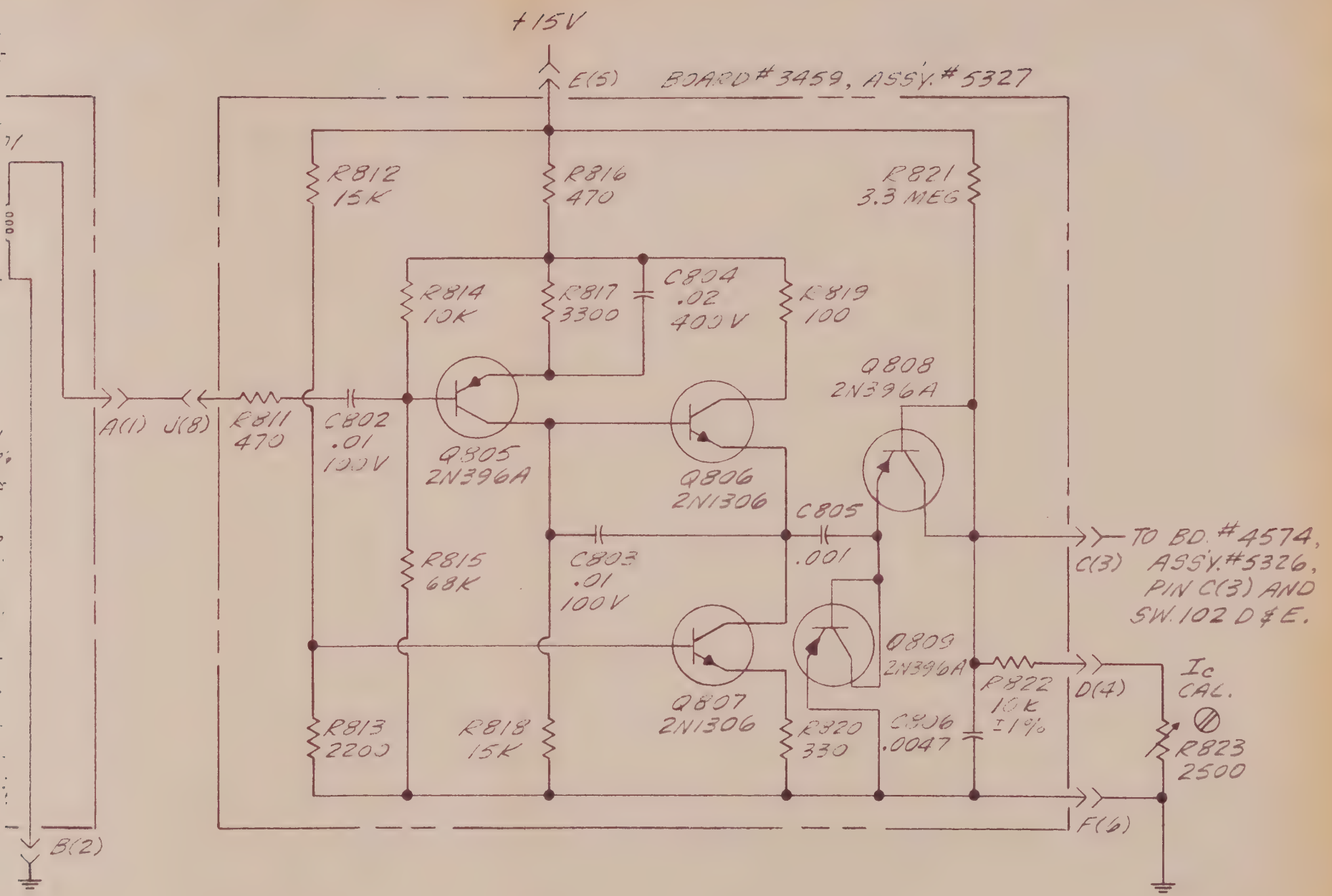

FLOATING GROUND
+15V
E(5)
BOARD #4096, ASSY. #5329
R703
22K
R705
6800
R706
330
R708
330
CR702
IN482A
CR703
IN482A
FLOATING
GROUND
A(1)
R712
10K
±1%
Q701
2N3644
Q702
2N3644
R704
220
Q704
2N3566
Q706
2N3566
R709
68
C701
390pf
Q703
2N3566
R710
68
R701
5600
Q705
2N3644
Q707
2N3644
R702
22K
CR701
IN709
R707
330
R711
330
F(6)
-15V
FLOATING GROUND



SCHEMATIC
CURRENT AMPLIFIER
MODEL 340

T-5407-E


+15V FLOATING GROUND
E(5)
BOARD #4089, ASSY. #5328
TO BD. #4096, ASSY. #5329, PIN K(19)
R802 6800
R804 470
CR806 IN709
Q803 2N3644
R807 27K
R808 10K
C801 .0033
C(3)
R801 470
Q801 2N3566
Q802 2N3566
CR802 CR803 IN482A
CR807 IN482A
CR808 IN482A
CR809 IN482A
CR804 CR805 IN482A
CR801 IN482A
R805 2700
R809 1000
R810 1000
CR810 IN482A
R803 6800
R806 2700
L(10)
F(6)
-15V FLOATING GROUND
FLOATING GROUND



SCHEMATIC
CONTROL OSCILLATOR AND
150 KHz RECTIFIER
MODEL 340

T-5408-C

P/O BD. #3459, ASS'Y. #5327, ASS'Y (13)

+15V

E(5)

P/O BOARD #4087, ASS'Y. #5330

K(9)

R902 41,200 ±1%

R904 12K

R908 13K ±1%

R909 1000 ±1%

R911 220

CR901 IN709

CR902 IN709

J4

Q903 2N3644

Q904 2N3566

R913 4700 ±1%

N.C.

N.O.

COLLECTOR/ DRAIN CURRENT

A(1)

S102C

R901 10K

Q901 2N3566

R905 200Ω ±1%

R906 200Ω ±1%

Q902 2N3566

Q905 2N3644

C902 25μf 25V

CR903 IN482A

CR904 IN482A

S102E

B(2)

C(3)

R903 100Ω ±1%

R907 1K ±1%

R910 1K ±1%

R912 220

-15V

TO VOLTMETER CIRCUIT

SUBJECT

BIAS

S901

VOLTAGE

R915 1000 ±1%

TO J101, PIN E(5)

R916 (3.4K) ±1%

R917 10K ±1%

R918 (3.4K) ±1%

3

10

20

GATE BIAS VOLTAGE VOLTS

S902

BOARD #5332

R917 10K ±1%

CR905 IN482A

CR906 IN482A

VOLTAGE

M901

+15V

P/O BOARD #4574, ASS'Y. #5326

R922 2200

R921 1K

CR907 IN482A

Q908 2N3644

C904 510 pf

R925 680

CURRENT ANALOG TO J601, PIN 3

Q907 2N3566

R926A *

B(2)

C(3)

Q910 2N3566

R924 3160 ±1%

R923 147 ±1%

CR910 20K ±1%

A(1)

M902

CURRENT

E(6)

R922 10K

R927 10K

L(10)

-15V

N.O.

P.U.F.

+15V

S102F

R928 10K

-15V

S102G

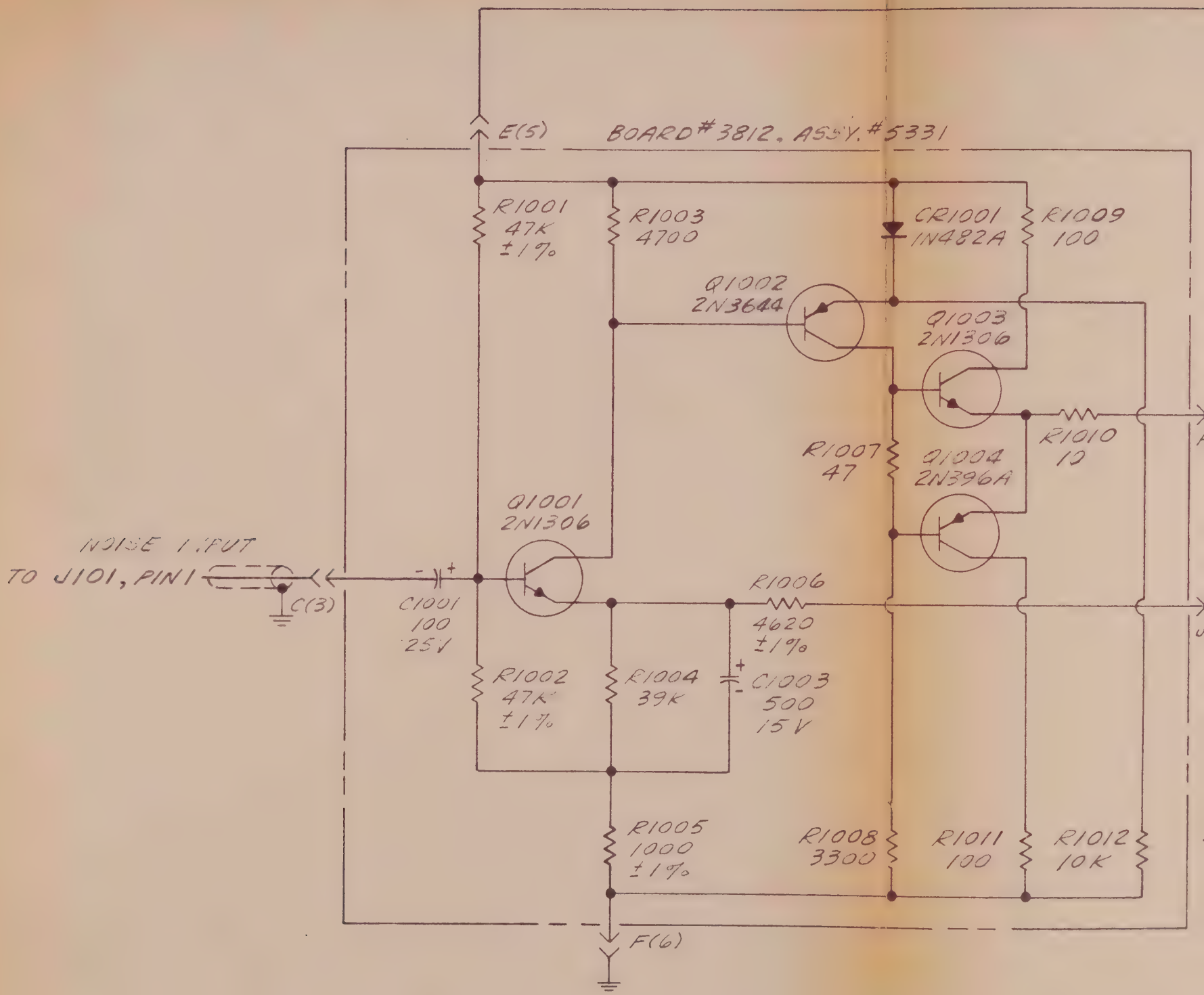
GATE BIAS VOLTAGE VOLTS

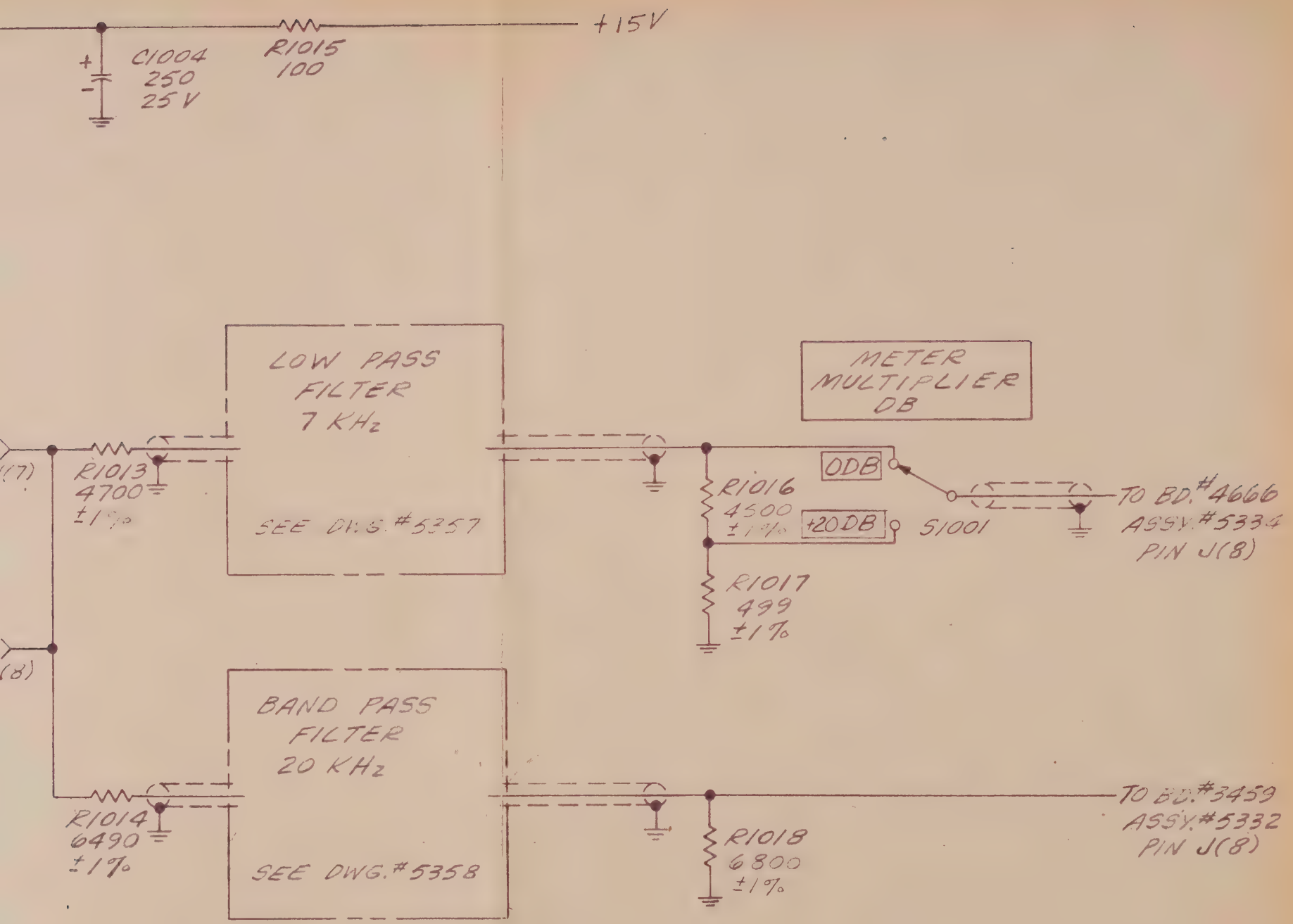
N.C.

P.U.F.

SCHEMATIC
AMMETER AND BASE SUPPLY
MODEL 340

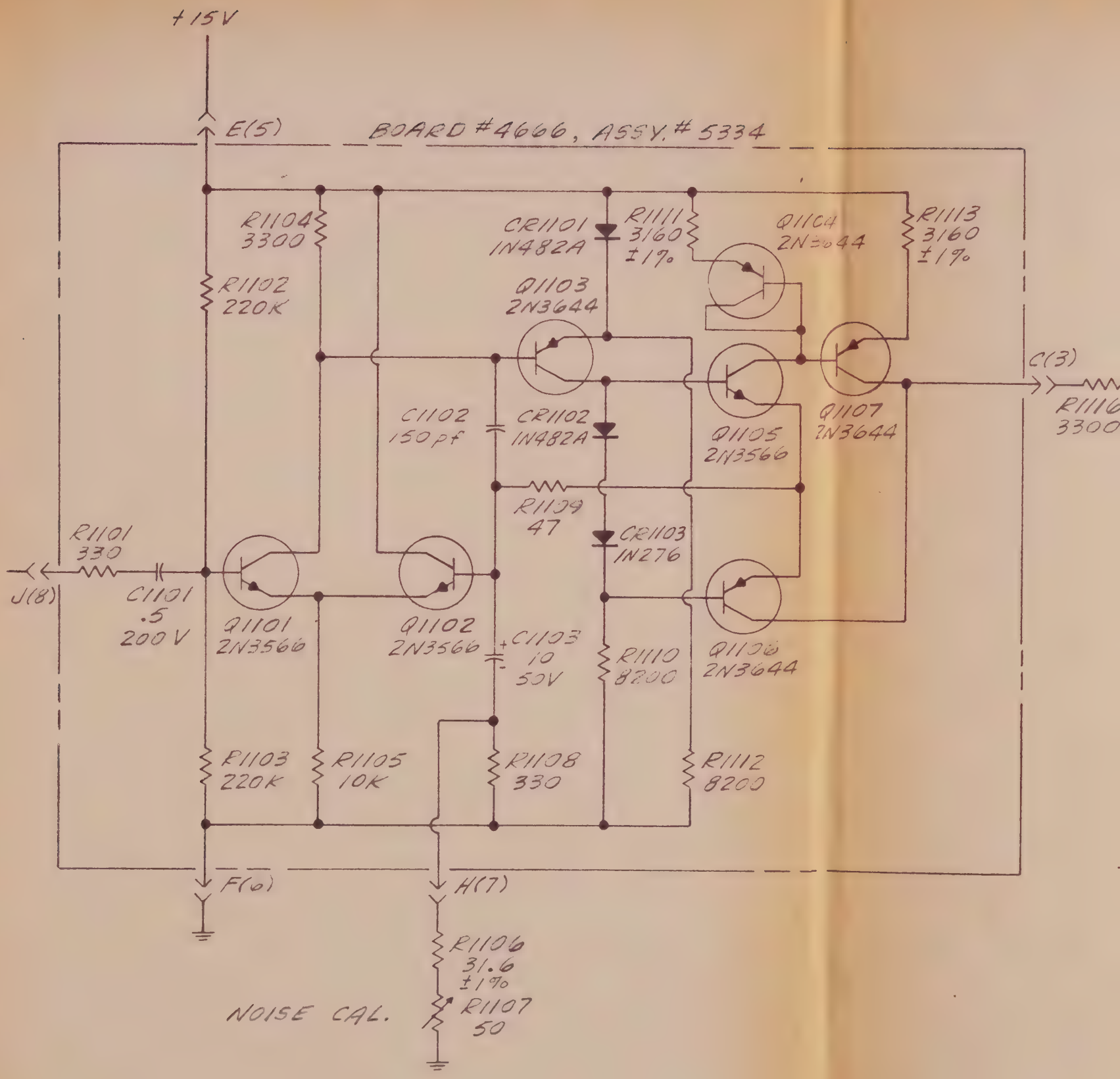
C-5409-E

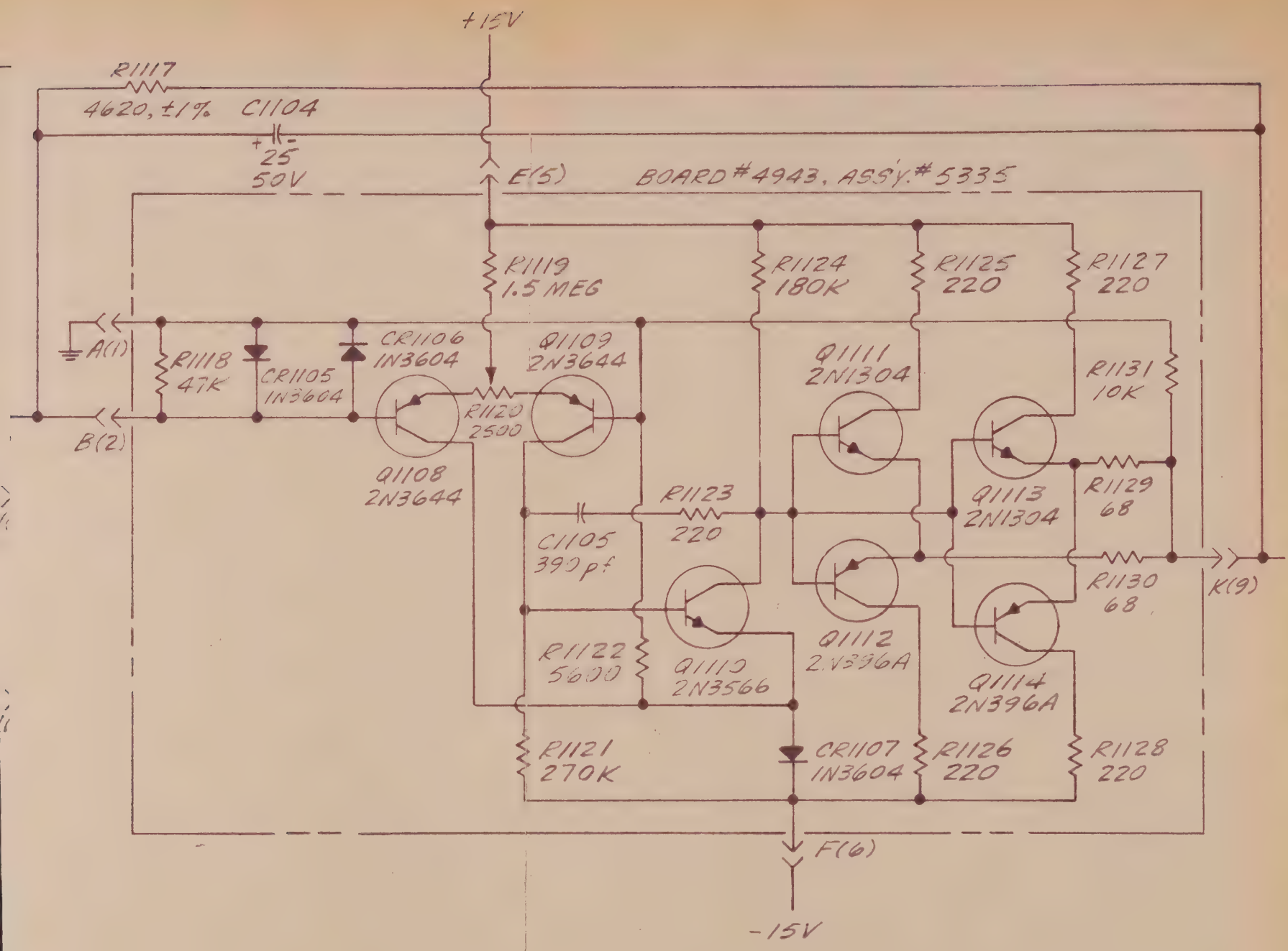

E(5)
BOARD # 3812, ASSY. # 5331
R1001
47K
±1%
R1003
4700
CR1001
IN482A
R1009
100
Q1002
2N3644
Q1003
2N1306
R1010
10
R1007
47
Q1004
2N396A
Q1001
2N1306
NOISE INPUT
TO J101, PIN 1
C(3)
C1001
100
25V
R1006
4620
±1%
R1002
47K
±1%
R1004
39K
C1003
500
15V
R1005
1000
±1%
R1008
3300
R1011
100
R1012
10K
F(6)



SCHEMATIC
ISOLATION AMPLIFIER AND
LOW PASS AND BAND PASS FILTERS
MODEL 340

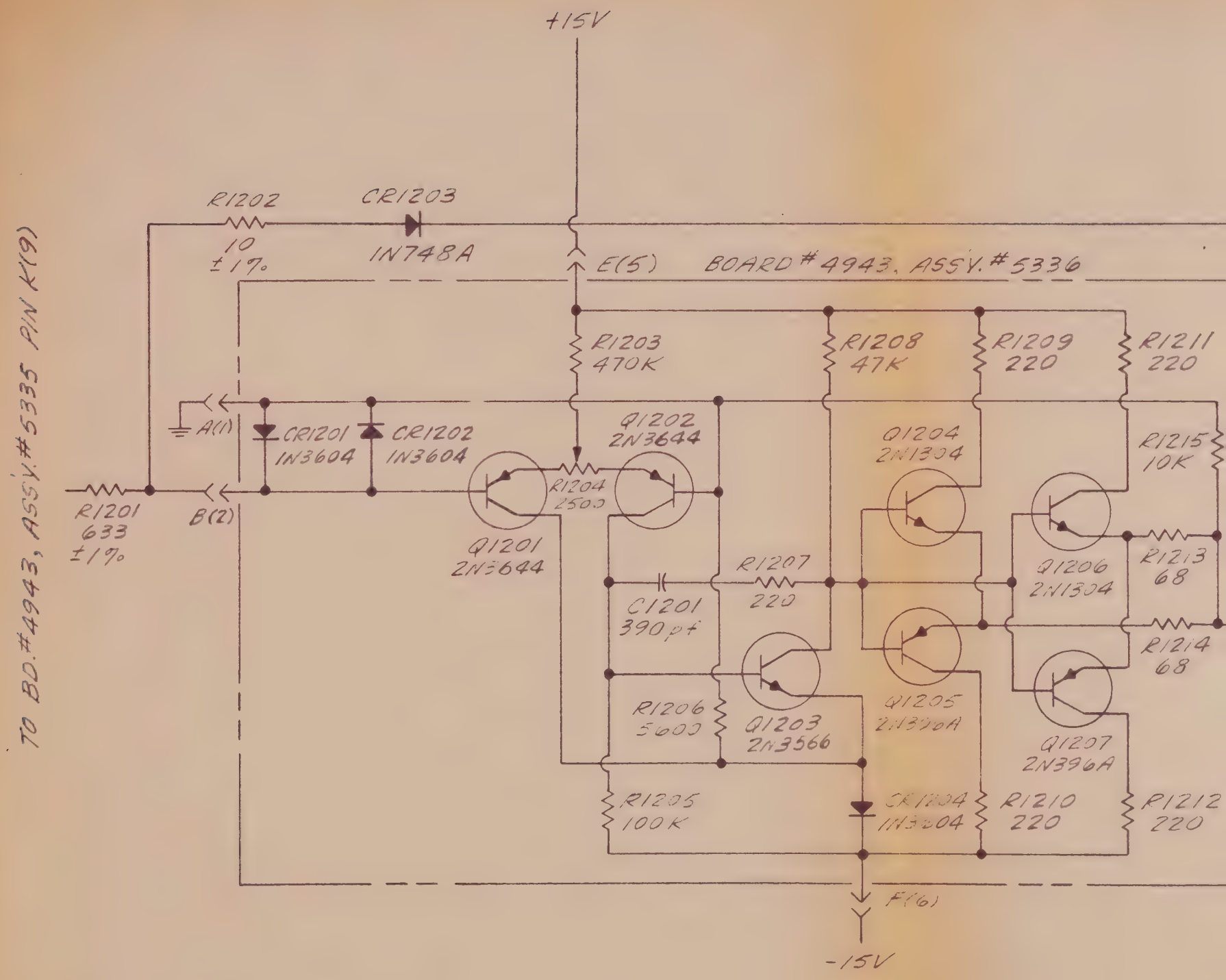
T-5410-C

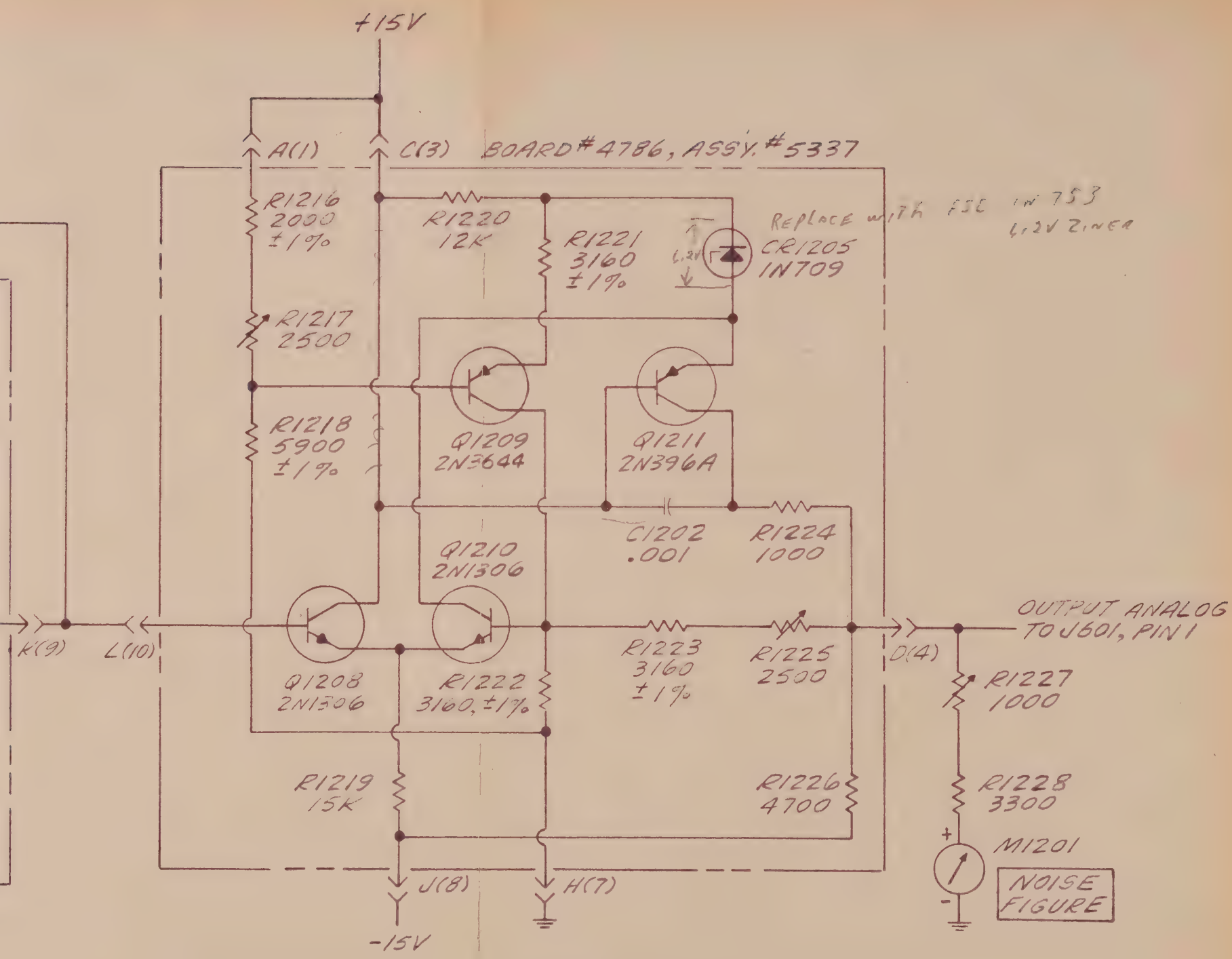

+15V
E(5)
BOARD #4666, ASSY. # 5334
R1104 3300
R1102 220K
CR1101 IN482A
R1111 3160 ±1%
Q1104 2N3644
R1113 3160 ±1%
Q1103 2N3644
C(3)
R1116 3300
C1102 150pf
CR1102 IN482A
Q1105 2N3566
Q1107 2N3644
R1109 47
CR1103 IN276
R1101 330
J(8)
C1101 .5 200V
Q1101 2N3566
Q1102 2N3566
C1103 10 50V
R1110 8200
Q1106 2N3644
R1103 220K
R1105 10K
R1108 330
R1112 8200
F(6)
H(7)
R1106 31.6 ±1%
NOISE CAL.
R1107 50
TO S1001 AND LOW PASS FILTER



SCHEMATIC
NOISE DETECTOR AND INTEGRATOR
MODEL 340

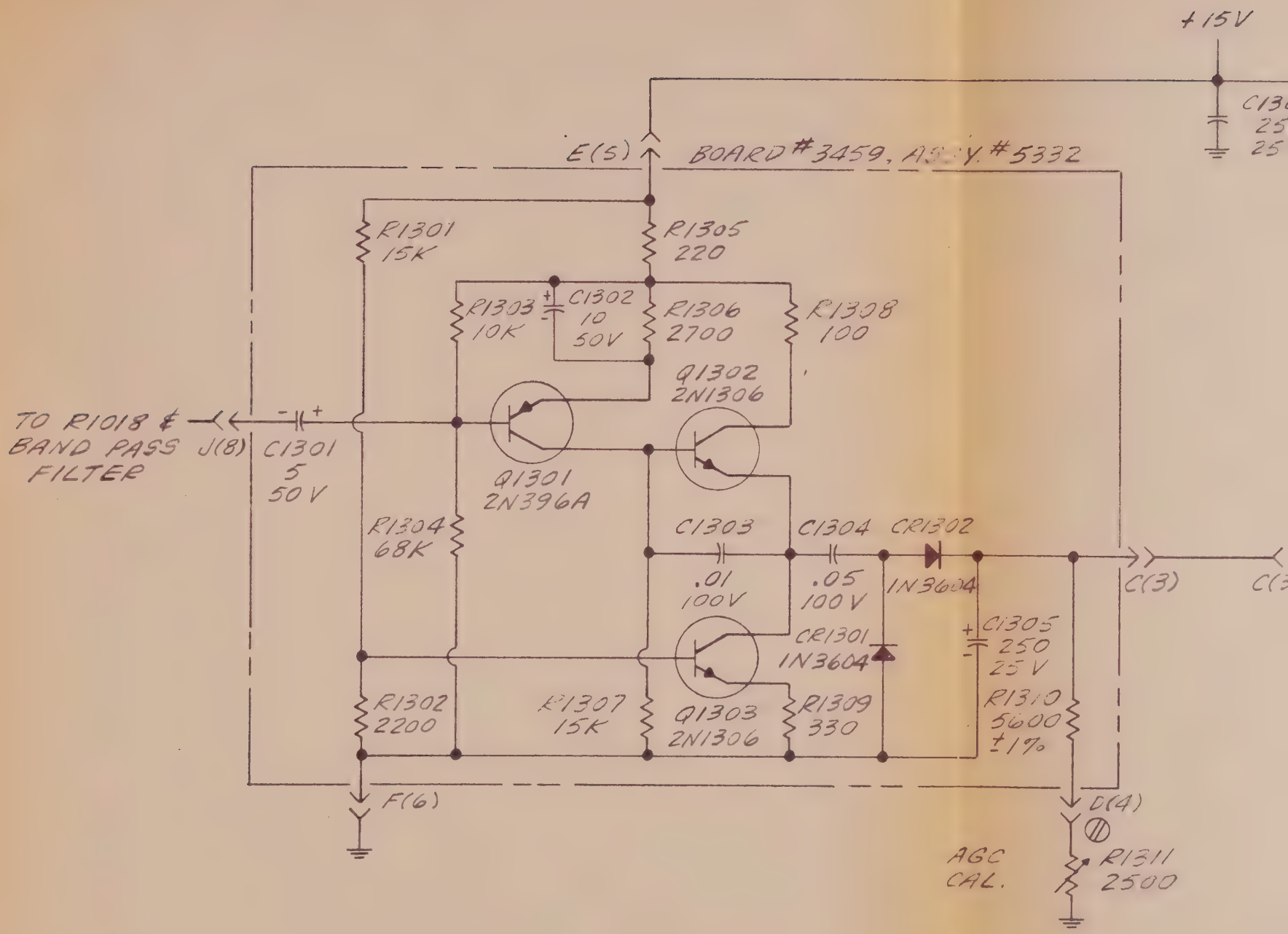
T-5411-D

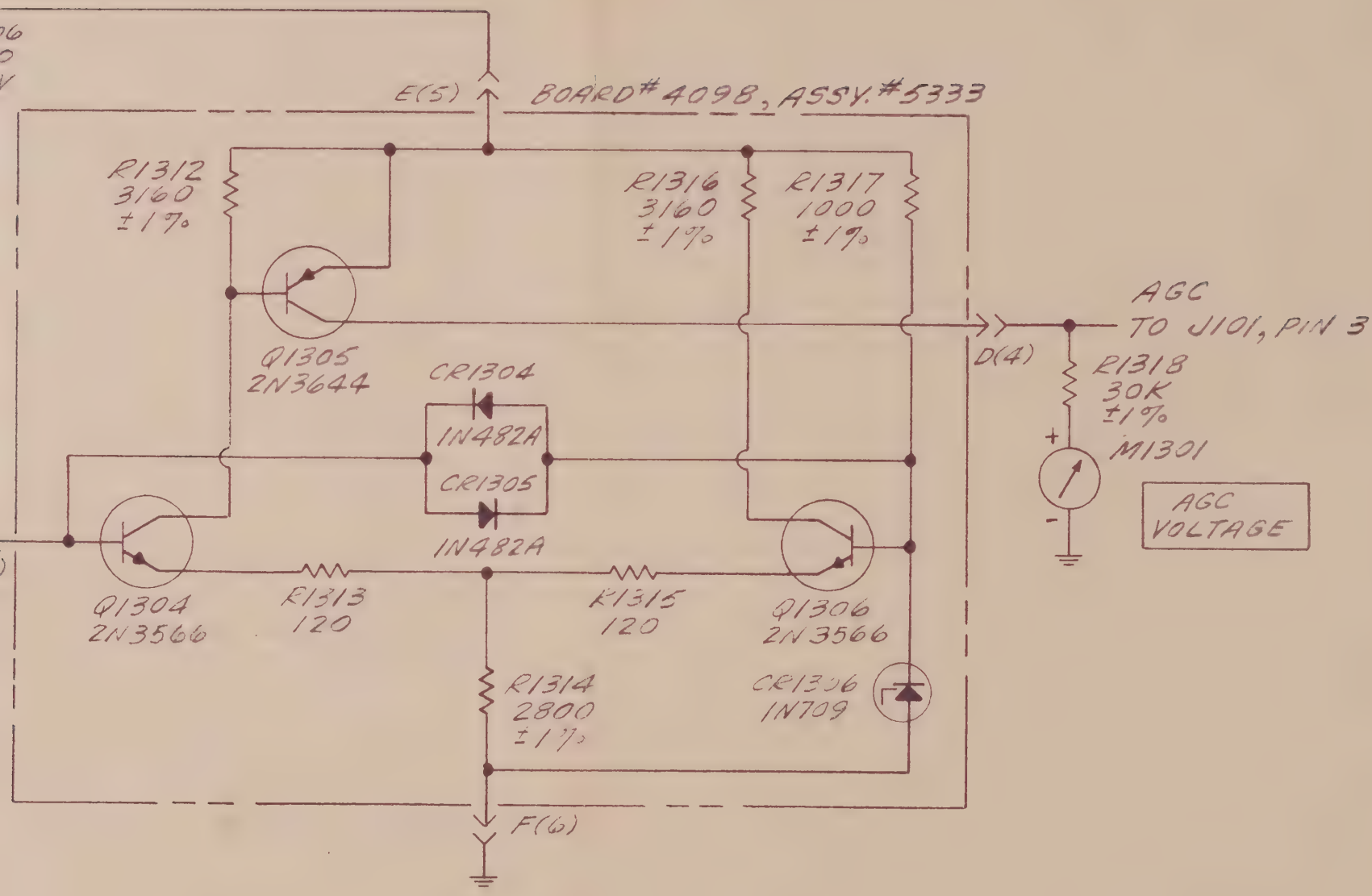

+15V
R1202
10
±1%
CR1203
IN748A
E(5)
BOARD # 4943, ASSY. # 5336
R1203
470K
R1208
47K
R1209
220
R1211
220
A(1)
CR1201
IN3604
CR1202
IN3604
Q1202
2N3644
Q1204
2N1304
R1215
10K
R1201
633
±1%
B(2)
R1204
250Ω
Q1201
2N3644
Q1206
2N1304
R1213
68
R1207
220
C1201
390pf
R1214
68
Q1205
2N396A
R1206
560Ω
Q1203
2N3566
Q1207
2N396A
R1205
100K
CR1204
IN3604
R1210
220
R1212
220
F(6)
-15V
TO BD. #4943, ASSY. #5335 PIN K(9)



SCHEMATIC
LOG CONVERTER AND OUTPUT AMPLIFIER
MODEL 340

T-5412-D


+15V
E(5)
BOARD #3459, ASSY. #5332
R1301
15K
R1305
220
R1303
10K
C1302
10
50V
R1306
2700
R1308
100
Q1302
2N1306
TO R1018 & BAND PASS FILTER
J(8)
C1301
5
50V
Q1301
2N396A
R1304
68K
C1303
.01
100V
C1304
.05
100V
CR1302
IN3604
C(3)
CR1301
IN3604
C1305
250
25V
R1302
2200
R1307
15K
Q1303
2N1306
R1309
330
R1310
5600
±1%
F(6)
D(4)
AGC
CAL.
R1311
2500



SCHEMATIC
AGC DETECTOR AND AGC DRIVER
MODEL 340

T-5413-C

Quan-Tech LABORATORIES, INC.

INSTRUMENTS • AMPLIFIERS • NOISE INSTRUMENTATION

SHORT FORM CATALOG

A Word About Noise Analysis

Since 1957 when it was founded, Quan-Tech Laboratories has specialized in the amplification and measurement of extremely low level signals approaching the theoretical limits of sensitivity. In order to build equipment of this sort it was necessary to select components having the lowest possible electrical noise for use in the most sensitive parts of the circuit. Noisier components were relegated to places where (it was thought) their noise would not interfere with proper operation. These noisy components exhibited a very high rate of failure compared to the quiet ones, so an intensive study of the reasons for these failures was undertaken.

Investigation showed that those components which exhibited excessive amounts of noise (particularly of the "1/f" type) compared to similar units, usually contained some defect or abnormality which could lead to early failure. This was equally true of resistors, transistors, and diodes, even though the failure mechanism might be different for each device.

This discovery led to the development of specific electrical noise measuring instruments for each type of component. Cooperative programs with manufacturers have proved beyond doubt that noise measurements, properly applied, can locate many types of failure-prone components before they are placed in the circuit, with resultant cost saving and increased reliability. Even manufacturers of such fiercely competitive items as automobile radios, electronic organs, and hearing aids have found noise screening cuts costs and improves product quality.

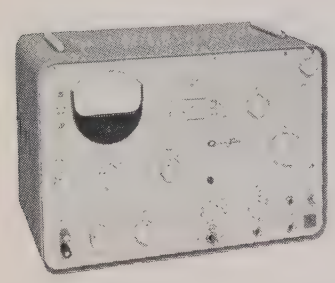
If you haven't already investigated the benefits of noise analysis, both for reliability and for very low noise applications, why not contact us or our local representative and get the full story?

Quan-Tech LABORATORIES, INC.

Quan-Tech LABORATORIES, INC.

WAVE AND SPECTRUM ANALYZERS

ACCURATE • VERSATILE • RELIABLE • PORTABLE • FIVE INSTRUMENTS
1 Hz to 200 KHz • ALL SOLID STATE



Model 304

LOW FREQUENCY WAVE & SPECTRUM ANALYZER

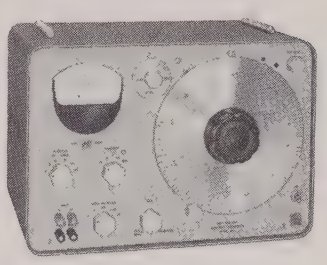
Frequency range: 1 Hz to 5 KHz; **Bandpasses:** 1, 10 & 100 Hz, selectable at front panel; **skirt selectivity:** 24 db per ½ bandwidth; **Voltage range:** 30 μV to 100 V, FS; down to .03 μV, FS, with accessory Model 206B preamplifier (see last page); **Tuning:** Manual or automatic; Internally supplied electronic sweep of total frequency range or of discrete portions; provision for external sweep; **Frequency calibration:** Linear 1 Hz per division; **Outputs:** BFO, restored signal, sample of automatic sweep, analogs of meter reading and frequency setting, phase output for phase plot on X-Y recorder. **Price:** $2450.

OPTIONAL FEATURES

Pen lift; AFC; Log, squared, or RMS meter reading; slave operation for multi-channel analyzer system. **Prices:** Upon request

WAVE AND SPECTRUM ANALYZER — Model 305

Similar to Model 304 except: **Frequency Range:** 10 Hz to 50 KHz. **Bandpasses:** 10, 100, and 1000 Hz and broadband, 10 Hz to 65 KHz. Also includes AFC, tracking filter operation, and built-in master-slave capability for multi-channel analyzer systems. **Price:** Upon request



Model 303

WAVE AND SPECTRUM ANALYZER

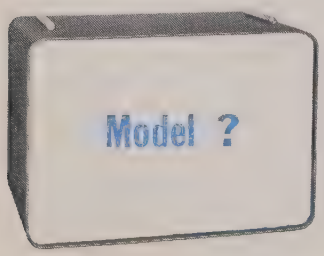
Frequency range: 30 Hz to 100 KHz. **Bandpasses:** 10, 30, 100, 1000 Hz, selectable at front panel. (100 and 1000 Hz bandwidths flat-topped for simplified noise computation, greater accuracy and convenient tuning. **Sensitivity:** 100 μV to 300 V, FS. Down to 1 μV FS with accessory Model 203 preamplifier (see last page). ± 300 Hz vernier; selection of long or short meter time constants; metering circuits compensated to minimize error from instantaneous noise pulses; overload-protected meter; analog output for external monitoring. **Price:** $1550.

WAVE AND SPECTRUM ANALYZER — Model 2156

Similar to above except: **Frequency range:** 10 Hz to 30 KHz. **Bandpasses:** 3, 10, 30, 300 Hz. **Price:** $2150.

WAVE AND SPECTRUM ANALYZER — Model 2223

Similar to above except: **Frequency range:** 10 Hz to 200 KHz. **Bandpasses:** 10, 100, 750, 1000 Hz. **Price:** Upon request.



Have we left you out?

While the analyzers listed above cover the great majority of applications, special requirements can often be met by a modification or minor redesign of an existing instrument. Let us know your problem and we'll see if we can't help solve it.

All prices shown are F.O.B. Whippany, N. J. Prices and specifications subject to change without notice.

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Quan-Tech LABORATORIES, INC.

TRANSISTOR NOISE ANALYZERS

R.F. TRANSISTOR NOISE ANALYZER

Measures noise figure directly of transistors and FET's at radio frequencies. Plug-in heads available for test frequencies between 1 MHz and 60 MHz. **Noise figure range:** 0 to 40 db. **Base resistance range:** 50, 100, 200, 500, 1K, 2K, 5K ohms. **Collector voltage range:** ±1 to 30 volts. **Collector current range:** 30 μa to 30 ma. **Price:** $2200.

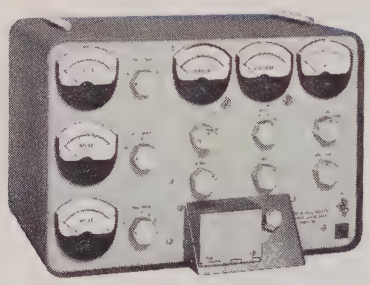
Heads available from $1250 up.

Model 340

TRANSISTOR NOISE ANALYZER

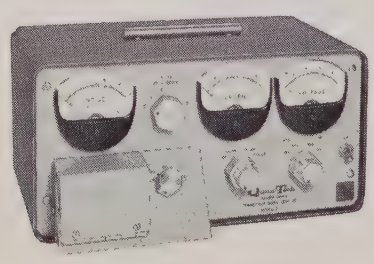
The most versatile unit available. Measures noise current and voltage at 10 and 100 Hz, 1, 10, and 100 KHz simultaneously. **Noise spectral density range:** 3 to 3000 nanovolts FS. **Base resistance range:** 0, 500, 1K, 10K, 100K, and 1M ohms plus external position. **Collector voltage range:** 0.3 to 60 volts. **Collector current range:** 0.3 μa to 30 ma. Also measures FET's. **Price:** $4995.

Model 2173C
-2181



Model 310 TRANSISTOR NOISE ANALYZER

Measures noise current and voltage at 100 Hz, 1 KHz and 10 KHz as well as 1_{cbo}, 1_{ebo} and beta. **Noise spectral density range:** 0.01 to 3 μV, FS. 1 to 300 pa, FS. **Collector current range:** 0.05 to 30 ma. **Collector voltage range:** 0.1 to 30 V. **Base resistance range:** 0, 500, 1K, 10K plus external position. **Price:** $2475.



Model 311 TRANSISTOR NOISE ANALYZER

Similar to above, except that collector current range is from 5 to 1000 μa for noise measurement in low-collector-current devices. Measures Gm instead of beta. Also measures FET's. **Price:** $2675.

Model 512 TRANSISTOR NOISE TEST SET

Measures broadband noise figure directly in db. **Noise bandwidth:** 15.7 KHz (—3 db at 10 Hz and 10 KHz). **Noise figure range:** 0 to62 db. **Collector voltage range;** ±3 to 30 volts. **Collector current range:** 10 μa to 1 ma. **Base resistance range:** 50, 500, 1K, 10K ohms plus external position. Also measures FET's **Price:** $1250.

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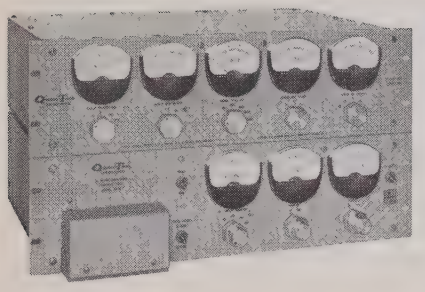
Quan-Tech LABORATORIES, INC.

- INTEGRATED CIRCUIT NOISE ANALYZERS
- RESISTOR & DIODE NOISE ANALYZERS
- SPECIAL INSTRUMENTS & SYSTEMS



Model 2283

Model 2181

INTEGRATED CIRCUIT NOISE ANALYZER

This extremely versatile noise measuring system was designed primarily for measuring noise in linear IC's and Op Amps. Simple plug-in PC cards enable it also to measure discrete components such as resistors, zener diodes, bipolar and FET's. Bias voltages: + and −12V fixed, + and −0 to 30V independently variable at 100 ma. Noise spectral density: 3 to 3000 nanovolts. Filter frequencies: 10 and 100 Hz, 1, 10, and 100 KHz measured simultaneously.

Price: Model 2283 Control Unit $1450.
Model 2181 Filter Unit $2500.

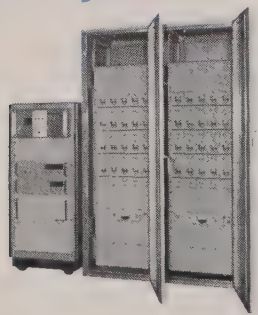
INTEGRATED CIRCUIT TEST SYSTEMS

On special order Quan-Tech can supply systems for measuring not only noise in IC's, but many other AC and DC parameters as well, such as DC offset voltage and current, differential DC offsets, open loop gain, etc. Readings are automatically sequenced, digitized, and stored, with optical readout and provision for printed or punch-card data storage.

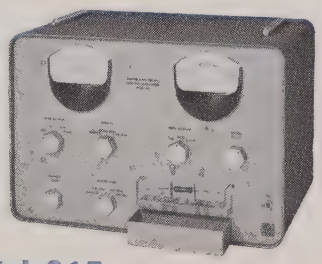
Special Instruments

Quan-Tech manufactures a great many "specials", ranging from one unit only to production quantities on an OEM basis. Our engineering department is extremely flexible and equipped to handle anything from minor modifications of standard instruments to the design and construction of an extremely complicated fully automatic noise measuring system. We are proud of our ability to meet difficult specifications that challenge the state of the art for low noise, stability, and accuracy. Your inquiry will receive a prompt reply.

Special Systems



A typical example of a large system designed exclusively for an individual customer's requirements is the **Model 5002,** built for Western Electric. The system has forty channels for detecting insulation breakdown or corona discharge in up to forty reels of transoceanic telephone cable during extended voltage breakdown tests. If any cable emits a noise pulse exceeding a preset level, a digital printer automatically prints out the cable number, test condition, time, and date.



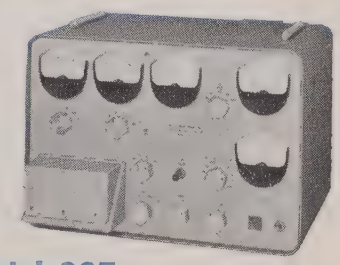
Model 315

RESISTOR NOISE TEST SET

Measures noise in resistors in conformance with specifications recommended by NBS and Method 308 of MIL STD 202B. **Test-resistor range:** 100Ω to 22 meg Ω. **Measurement range:** 0.6 μV in a decade to 1000 μV in a decade. **Outputs:** Sample of noise voltage; analogs of meter readings. External cable supplied for remote location of test jig. **Price:** $2150.

MODEL 2136

Similar to above, but measures resistors down to 10 Ω. **Price:** $2300.



Model 327

DIODE NOISE ANALYZER

Measures noise in back-biased semi-conductor diodes at 10 Hz and 1 KHz simultaneously. **Noise spectral density range:** 0.03 μV to 1 mV. **Test Voltage:** 0 to 500 V, continuously variable. **Test current:** 0 to 100 ma, continuously variable. Internally supplied ramp automatically sweeps test current and/or voltage within maximum ratings. A wide variety of outputs for data logging, external monitoring, actuating external equipment, etc. **Price:** $2750.

TYPE 1115 JIG AND TRANSFORMER

For measuring noise in forward-biased diodes up to 100 ma. **Price:** $300.

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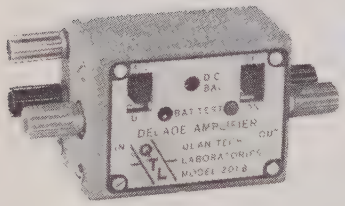
Quan-Tech LABORATORIES, INC.

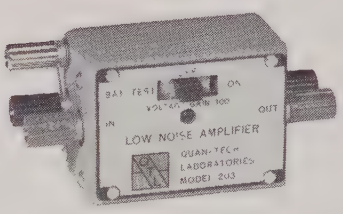
- **SOLID STATE AMPLIFIERS**
- **AMPLITUDE DISTRIBUTION ANALYZER**
- **RANDOM NOISE GENERATOR**



Model 201B

DC DECADE AMPLIFIER AC OR DC COUPLED

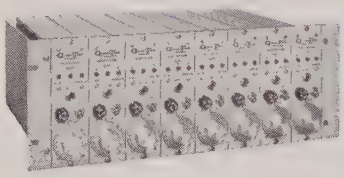
Bandwidth: DC or 10 Hz to 3 MHz (3 db); **Gain:** 10 (fixed); Power: Self-contained batteries; 600 hour life. **Price:** $110.



Model 203

LOW NOISE AC AMPLIFIER

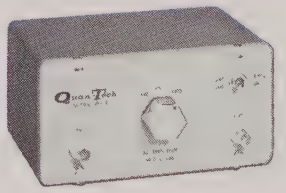
Bandwidth: 30 Hz to 100 KHz (± 0.5 db); —3 db at 500 KHz; **Gain:** 100 (fixed); **Typical noise spectral density:** 5 x 10^{-9} V and 3 x 10^{-12} A at 1 KHz. Battery powered. **Price:** $125.



Model 2220

INSTRUMENTATION AMPLIFIER

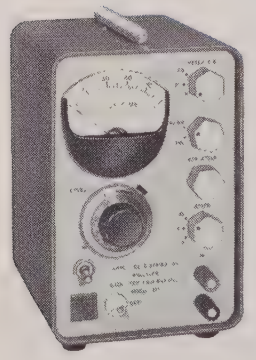
Modular amplifiers mount 8 units in a 7″ rack panel. **Voltage gain:** 0 to 80 db in 5 db steps. **Controlled frequency characteristics:** (selected by plug-in cards) voltage gain flat 10 Hz to 100 KHz or 10 Hz to 20 KHz, rising 3 db/octave 10 Hz to 100 KHz or 6 db/octave 10 Hz to 20 KHz. **Price:** $590.



Model 206B

SELECTABLE GAIN AC AMPLIFIER

Bandwidth: 1 Hz to 100 KHz (within 0.5 db); —3 db at 500 KHz. **Typical noise spectral density:** 5 x 10^{-9} V and 3 x 10^{-12} A at 1 KHz. **Gain:** 10, 100, & 1000, selectable at front panel; **Power:** 105-125 V AC or optional self-contained battery pack (automatically recharging). **Price:** $175. Batteries $25.



Model 317

AMPLITUDE DISTRIBUTION ANALYZER

Determines amplitude-probability distribution of random signals. **Amplifier response:** 3 db down at approx. 12 Hz and 1 MHz; **Switching rate:** 5 MHz. **Amplitude ranges:** 100%, 10%, 1% FS; Normal or "inverted" operation; provision for external sweep of level. **Price:** $450.

Model 420

RANDOM NOISE GENERATOR

Stable "white" noise output having true gaussian amplitude distribution. **Frequency range:** DC to 100 KHz; **Output spectral density:** 0.01 to 1000 μV, continuously variable, calibrated; **DC offset:** less than 10 mV at max. output. **Price:** $550.

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Representatives List

New England

VECTOR SALES, INC.
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Belmont, Mass. 02178
617-489-1400

P.O. Box 87
Milford, Conn. 06460
203-TR 4-2112

New York State

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Southern California, Arizona

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Pasadena, Calif. 91101
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213-SY 5-7081

Canada

ATLAS INSTRUMENT CORP.
50 Wingold Ave.
Toronto 19, Ontario
416-781-6174

3333 Cavendish Blvd.
Suite 390
Montreal, Quebec
514-HU 9-8495

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ALL Export (Except Canada)

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